MECCANO® Magazine

MARCH 1969

TWO SHILLINGS
AND SIXPENCE

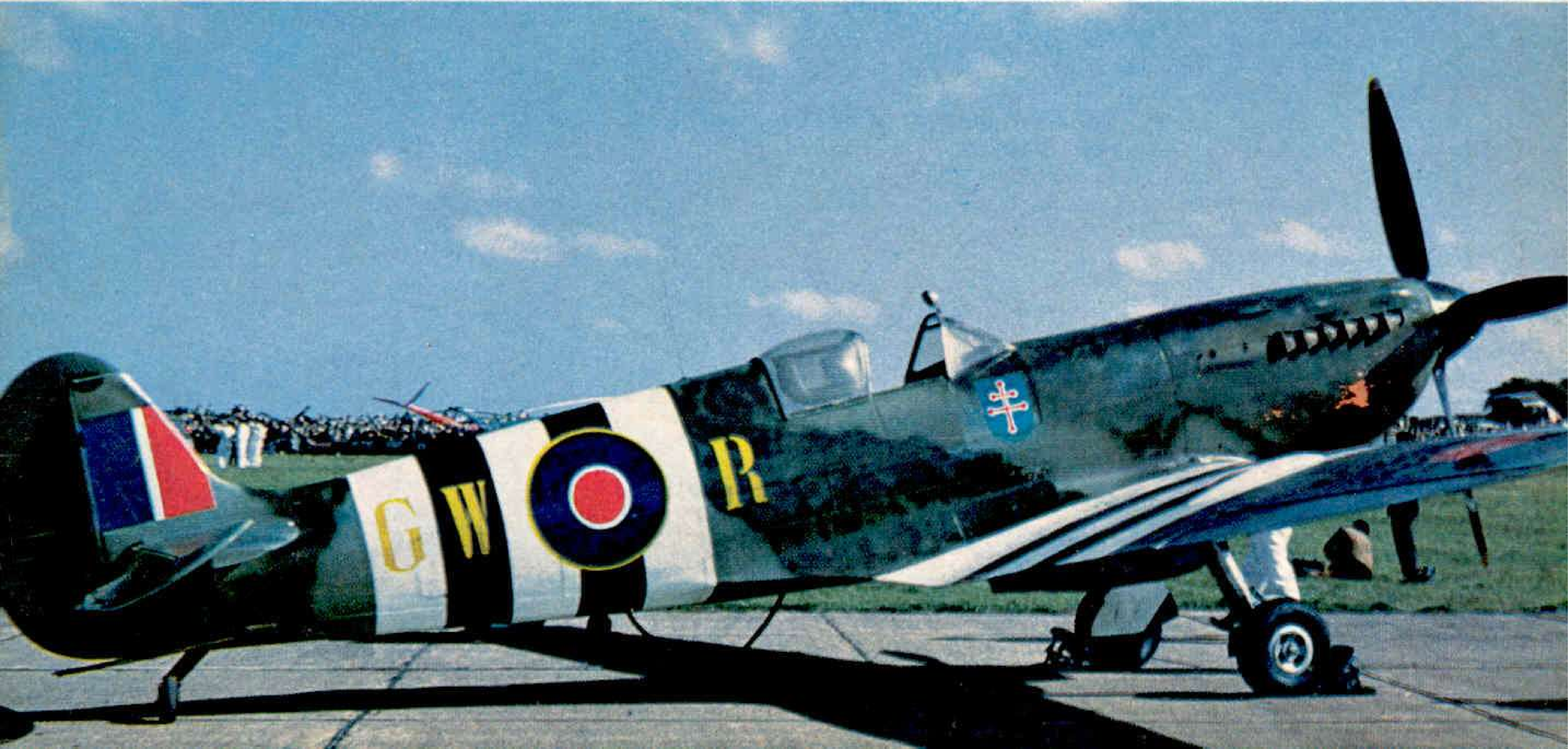
U.S.A. AND CANADA 60 CENTS.

MAP

HOBBY MAGAZINE

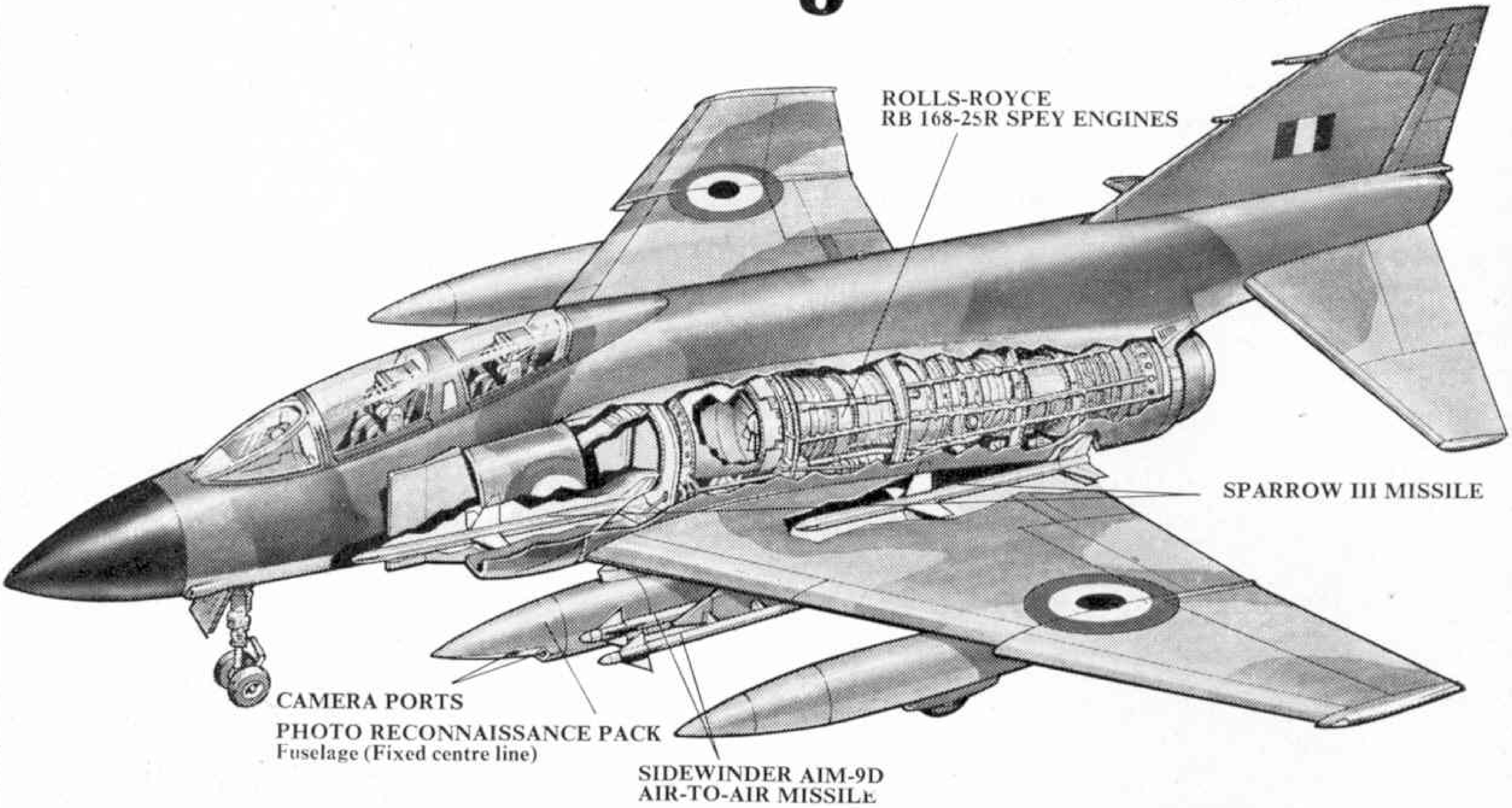
★ SPITFIRE HISTORY ★ SPITFIRE PLASTIC MODEL ★ SPITFIRES ON STAMPS ★ SEVEN MECCANO MODELS ★ FIRE FIGHTING ★

RAILWAYS PLASTICS AEROMODELLING BOATS CARS STAMPS MECCANO SCIENCE



BEHIND THE SCENES WITH THE R.A.F.-3

The Phantom–the great all-rounder

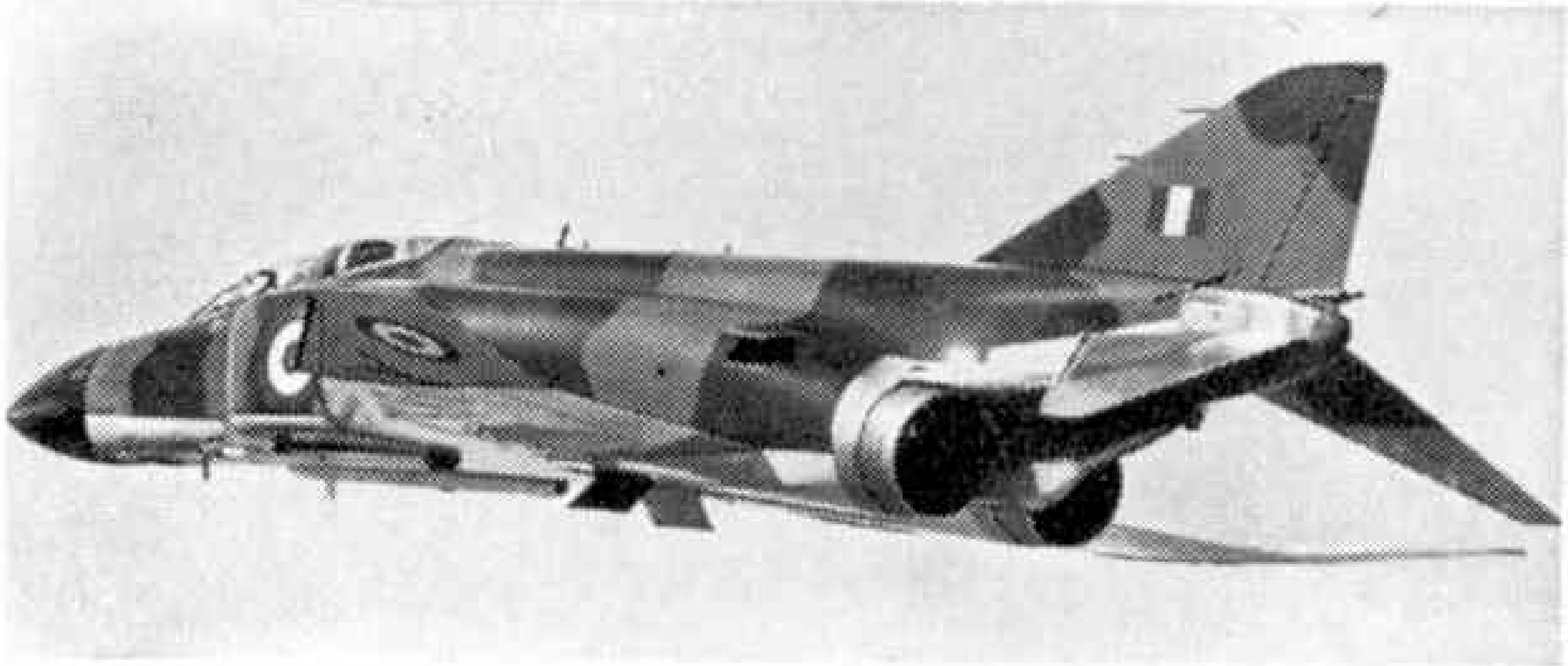


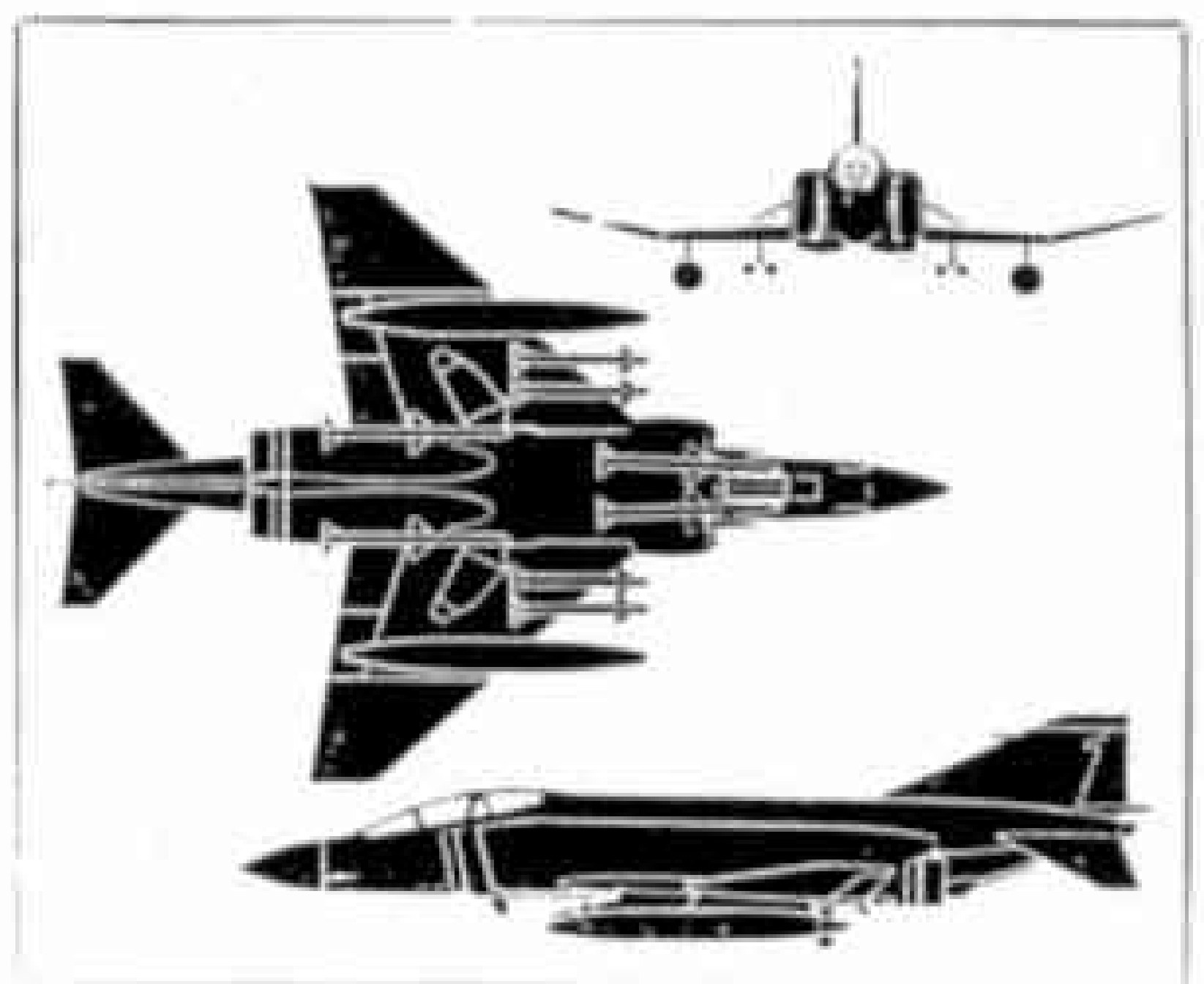
The Phantom is three aircraft in one. It carries five tons of weaponry that can vary according to the mission it goes on: missiles for fast fighter interception; bombs; rockets for ground attack; or a photographic pod for high-definition reconnaissance.

Its strike power is devastating; it can carry eight air-to-air missiles. Its six-barrelled gun can fire a hundred rounds per second.

Packed into its fuselage is a mass of advanced electronics. Wonders like the automatic navigation-attack system. When a map reference of the target is fed into the Phantom's navigation computer, a light appears on the gun sight and indicates to the pilot the target's position. Then there's the pulse doppler radar system, that zeroes on to moving objects.

The Phantom is technically the most complex aircraft in the R.A.F. To fly it and keep it in top operational shape needs dozens of different skills . . . aircrew, technicians, mechanics, fitters, fire-fighting experts, suppliers, administrators, security men—all kinds. And for all of them, the R.A.F. provides a first-class, full-time training. If you're interested in aircraft and technology, the R.A.F. might be the life for you one day. Think about it.





From 17½ onwards, you could come in as a trade trainee. Or with 5 acceptable O-Levels, you could start training as an officer.

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Royal Air Force

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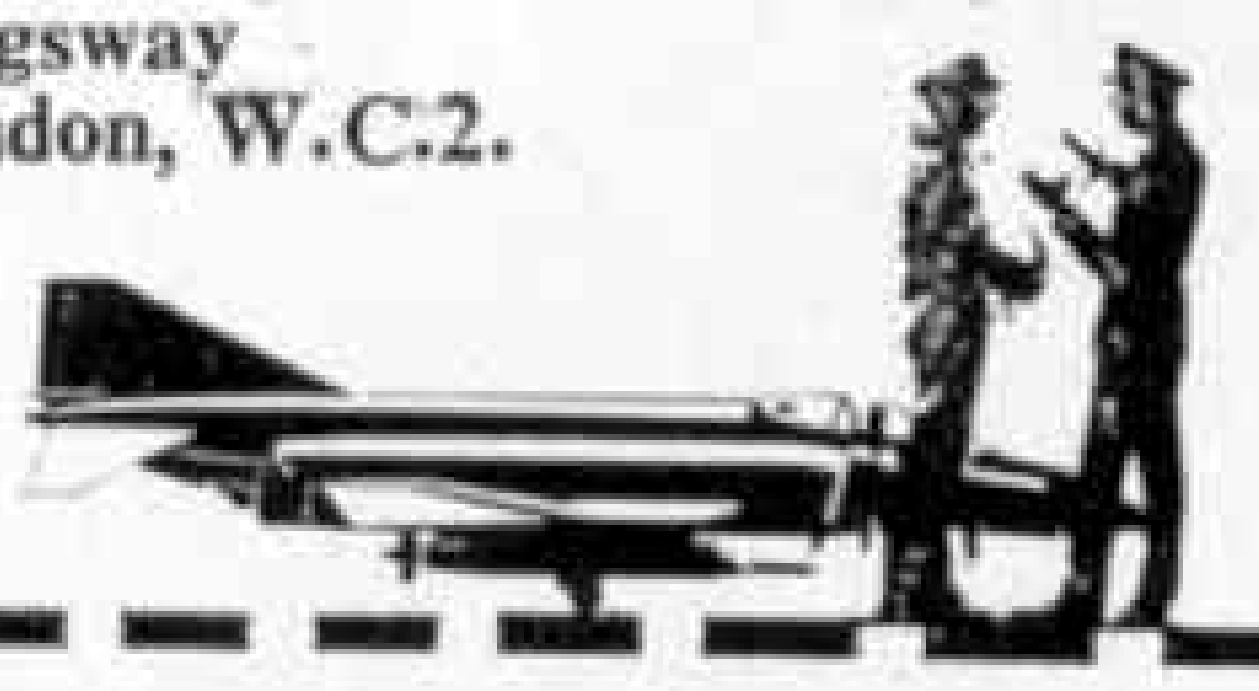

MECCANO® Magazine

MARCH 1969 VOLUME 54 NUMBER 3
Meccano Magazine, founded 1916.

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J. D. McHARD
Advertisement Manager
ROLAND SUTTON

MAP **HOBBY MAGAZINE**

FRONT COVER

Our double Spitfire cover will be of special interest to historical aviation fans, as both the aircraft have a long tale (no pun intended). The top Spitfire, AB 910 is a wartime built Mk5 that served with No 53 Operational Training Unit. After the war its makers looked after it at Weybridge in Surrey and it was then presented to the R.A.F. It now belongs to the R.A.F. Memorial Flight at Coltishall and can be seen in the forthcoming "Battle of Britain" film. The lower Spitfire G.W.R. is a Mk9 painted in the markings of the Free French Air Force, note the cross of "Lorraine". This was a Belgian Air Force machine, then a privately owned aerial target tug and then a film star in "The Longest Day"—as shown, and the "Battle of Britain" with markings of that period. **Photos by Aviation Photo News.**

NEXT MONTH

The main theme for April Meccano Magazine is nautical with such eye opening features as "Leviathans of the Deep" describing the super tankers now plying around the world. An excellent technical feature describes the "Model Ship Basins" where hull designs are tested before production and to round it all off we have a feature that describes large size models that are piloted through scaled down canals by trainee Captains and crew. Full size plans are presented for a simple rubber driven aircraft by Ray Malmstrom and "Air News" is back again. Meccano models include a "Universal Milling Machine" for advanced model builders, two French models—an "Amphibian Truck" and a little "Golf Course Grass Cutter". Also for the novice, we feature a small "Gantry Crane" and lots of ideas in "Among the Model Builders" with Spanner. Other features include Coin Collecting; Have you Seen; Book Reviews: Battle; Militaria; Great Engineers and Away from the Sea in Ships—a tale of life on a canal.

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Publishers of Aeromodeller, Model Boats, Model Cars, Model Engineer, Radio Control Models, Model Railway News.

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model shops who specialise in MECCANO spare parts

Dealers wishing to advertise on this page should contact **MECCANO LTD., LIVERPOOL direct,** M. A. P. do not accept bookings for this page.

Listed below are some of the dealers who sell Meccano accessories and spare parts. This is intended to aid enthusiasts—and there are many of them—who constantly require additional spare parts for their sets. All dealers can, of course, order Meccano spare parts for their customers, but those listed here are among our spare part specialists.

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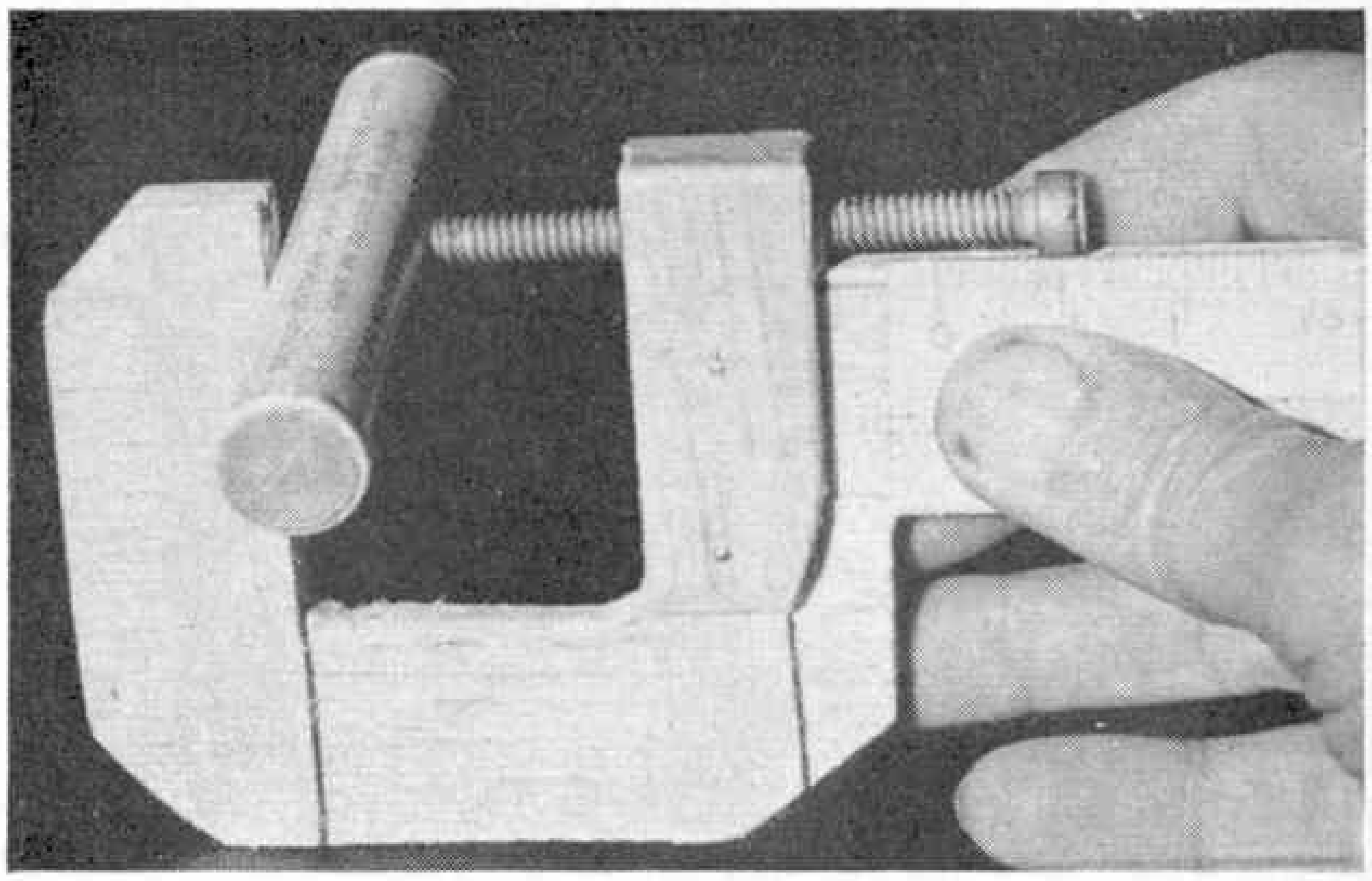
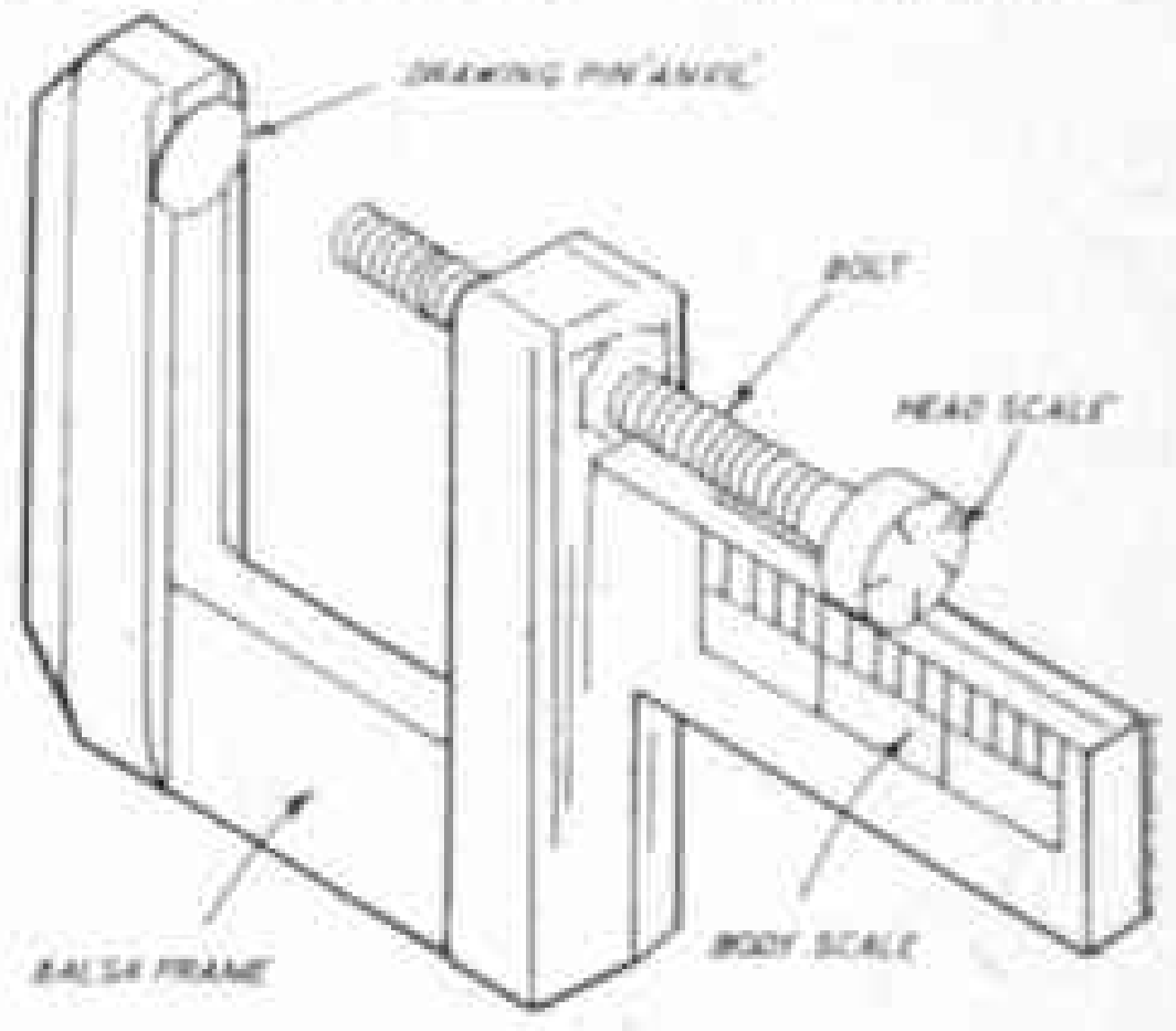


A MICROMETER IN BALSA

It sounds ridiculous, doesn't it—yet this little instrument which you can make for a few pence is a real working micrometer with quite good accuracy. And there's a step-by-step plan and full instructions on how to use the micrometer available to 'MM' readers—*see below*. It's just another example of how useful Solarbo Balsa is for all sorts of projects, not just straightforward modelling. That's mainly because Solarbo is top quality Balsa, specially selected and graded for modelling and other 'making' jobs. For any job that can be tackled in balsa, start right with Solarbo Balsa. We *know* it's right for the job—even for a simple micrometer, a slide rule, caliper rule, etc. There's plenty of ideas to choose from below!



Please send me the plans marked. I enclose Postal Order value 1/- 2/6* as per your special Meccano Magazine offer. (Plan prices—Four for 1/- or Twelve for 2/6—post free.)

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6. Ocean Terminal	6	7	6
7. Mountain Engineer	8	13	6
8. Breakdown Crew	14	18	6
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10. Meccano Outfit in 4-Drawer Cabinet	66	15	0
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Meccano Mechanisms Set	2	5	0
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No. 3a ,, ,, 3 ,, ,, 4	1	9	11
No. 4a ,, ,, 4 ,, ,, 5	1	15	6
No. 5a ,, ,, 5 ,, ,, 6	1	8	6
No. 6a ,, ,, 6 ,, ,, 7	2	7	6
No. 7a ,, ,, 7 ,, ,, 8	5	19	6

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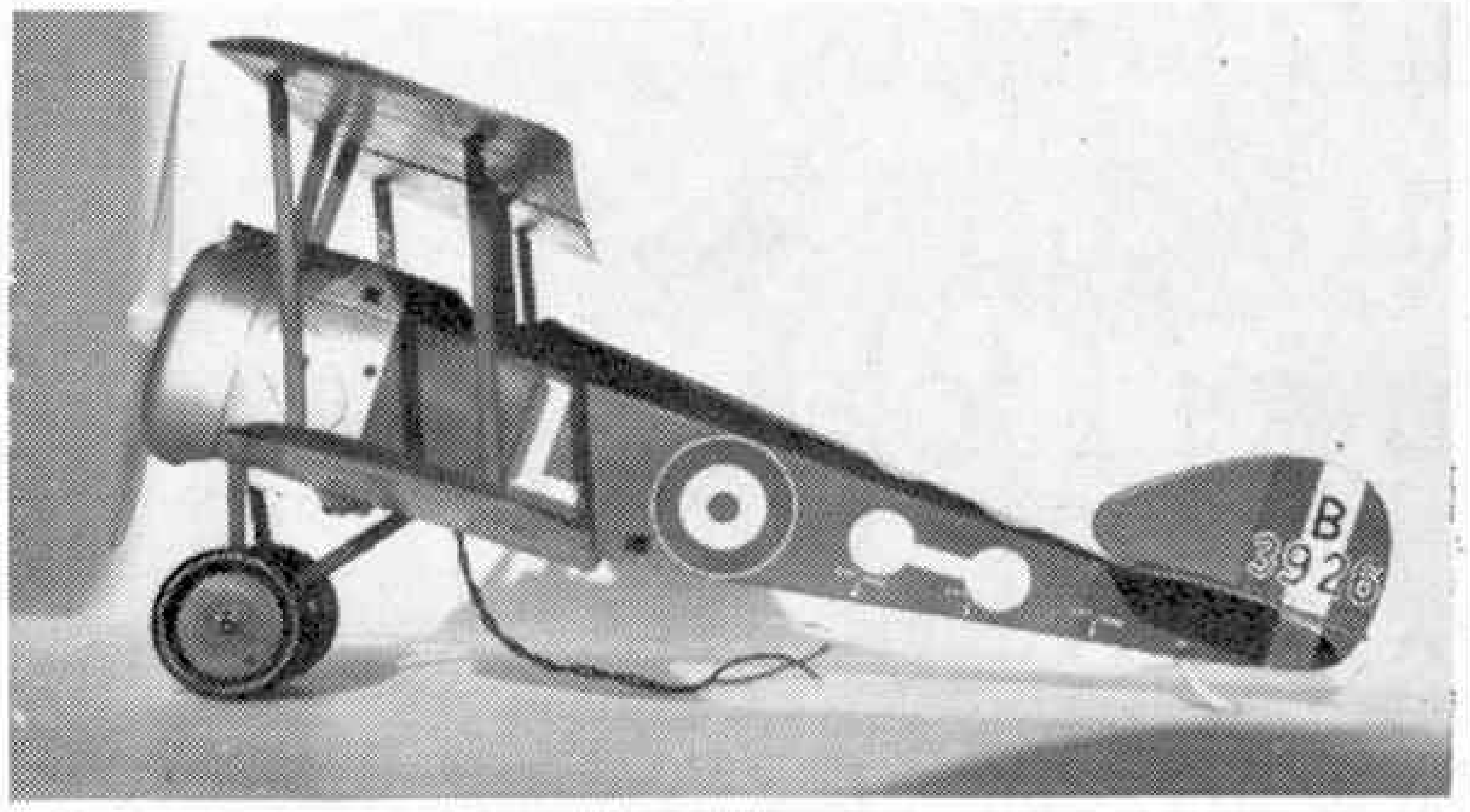
E15R Electric, reversing*	3	5	0
EMEBO Electric Motor (Battery operated)	1	8	6
43901 B Key for No. 1 Clockwork Motor		1	3
43903 S Key for Magic Clockwork Motor			6

* Fitted with T.V. and Radio interference suppressors.

SPARE PARTS

The Meccano range of Spare Parts consists of more than 300 individual items, all of which are available for separate sale. A price list can be had on application.

AEROMODELLER

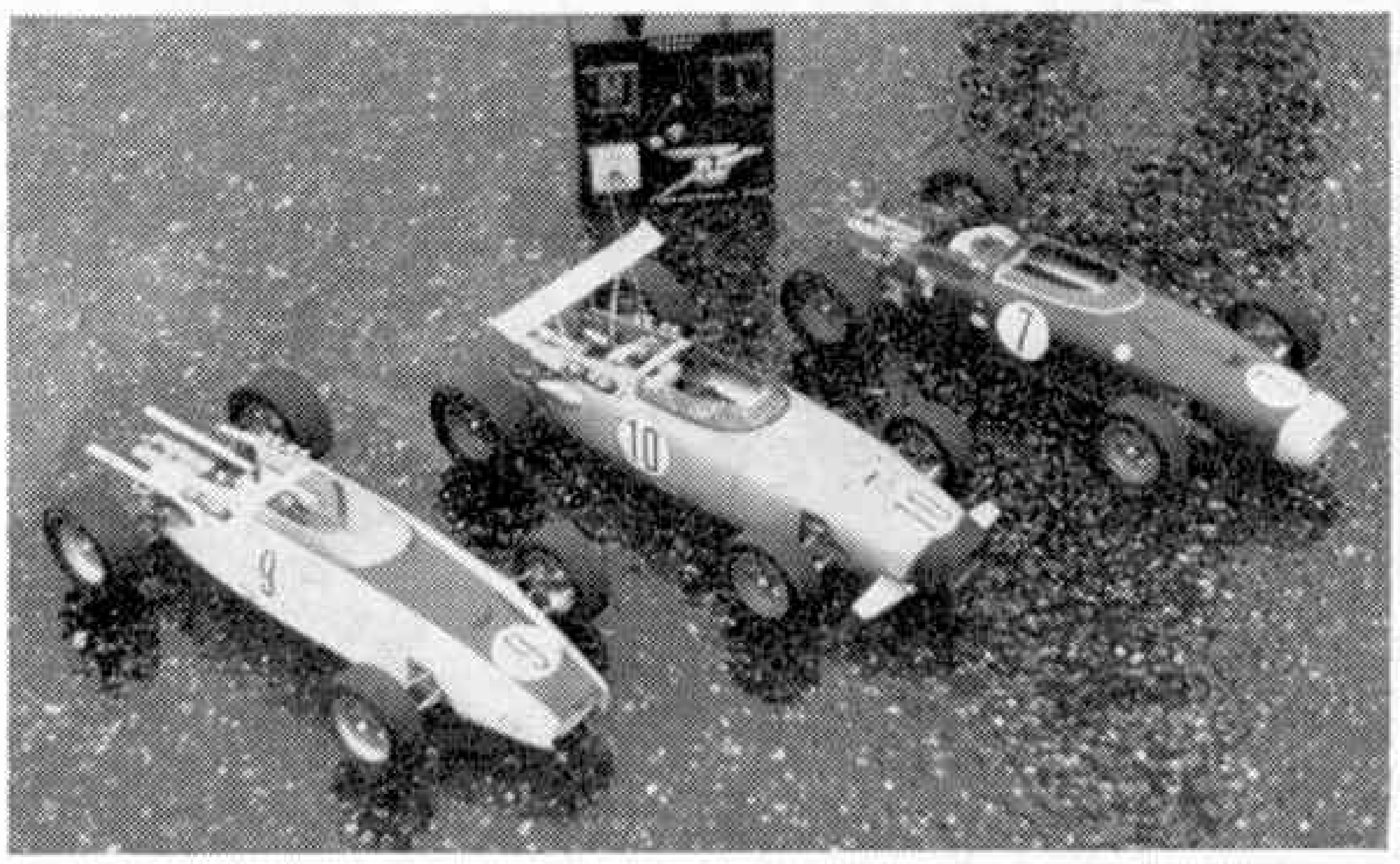


CAMEL WITH THE AMP!

Full story of the fascinating electric powered round the pole models as demonstrated by aeromodeller staff at the "Model Engineer" Exhibition shows how anyone with Meccano parts and Slot Car controllers can enjoy this new kind of indoor flying. Scale plans for the Jurca Tempete and Sirocco, Engine test, glider development plus plans of a leading contest glider are other topical features. Part two of "Topsy" the do-it-yourself small (0.375 c.c.) engine and advice on radio control are supported by regular features, out on February 21st.

3rd FRIDAY MONTHLY 2/6

MODEL CARS



1/32nd scale plans for the 1969 Can-Am Ferrari should provide slot racers with another topical and popular Prototype. Articles from John Veasey and a new contributor on modern chassis building together with a photo feature on radio controlled cars in action are two of the leading highlights with a look at the models on show at the Model Engineer Exhibition, building Champion motors from kits and all the regulars for collectors, i.e. Autominology, The Taylor and Barrett Story Part Two, Auto Models Club and Collectors' Corner provide lots more interesting reading. Free with this issue the 1969 E.C.R.A. Handbook, a must for all slot racers.

1st FRIDAY MONTHLY 2/6

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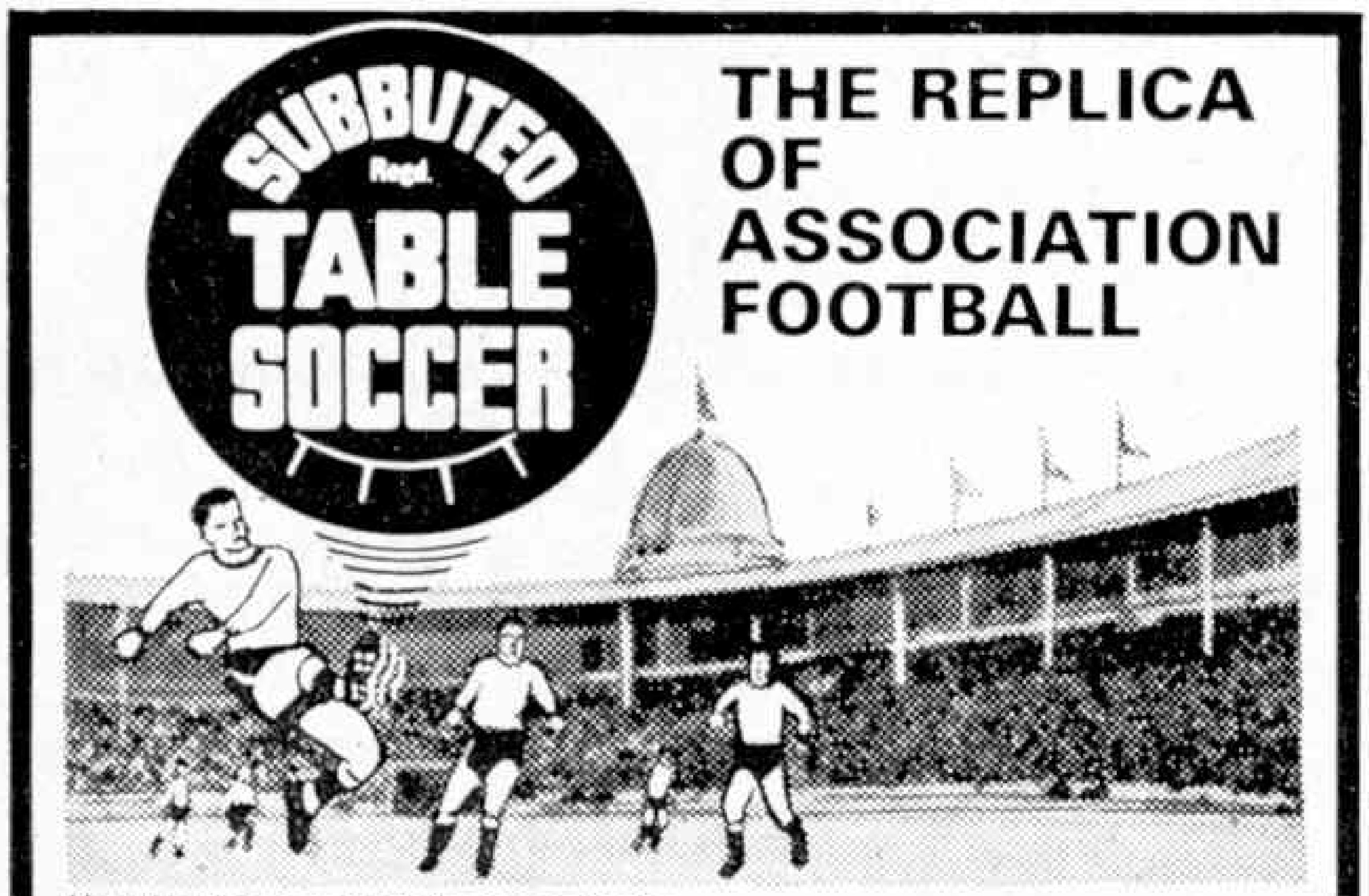

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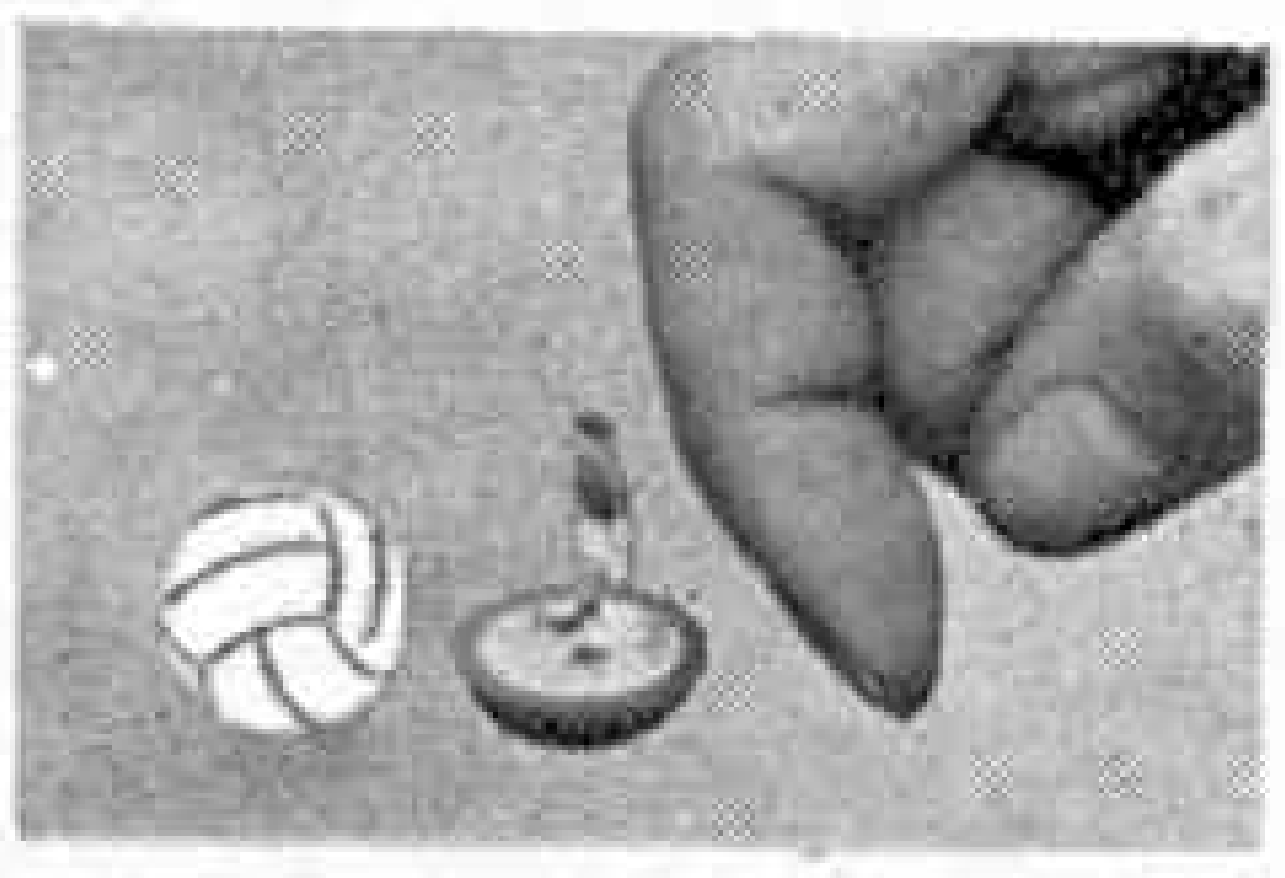

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MARCH 1969 COUPON

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HB.3 Ocean Grey
HB.4 Duck Egg Blue
HB.5 Sky Type S
HB.6 Sea Grey Medium

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HG.2 Dunkelgrun 71 (Dark Green)
HG.3 Hellgrau 76 (Light Grey)
HG.4 Dunkelgrau 74 (Dark Grey)
HG.5 Helblau 65 (Light Blue)
HG.6 R.L.M. Grau 02 (R.L.M. Grey)

KIT 3
U.S.A.F.
HU.1 Medium Green 42
HU.2 Olive Drab 41
HU.3 Neutral Grey 43
HU.4 Non Specular Sea Blue
HU.5 Intermediate Blue
HU.6 Light Grey

KIT 4
FLEET AIR ARM
HB.7 Extra Dark Sea Grey
HB.8 Dark Slate Grey
HB.5 Sky Type S
HB.9 Sea Blue Gloss
HB.10 Night Black
HB.11 Underside White

KIT 5
ROYAL AIR FORCE
(OVERSEAS)
HB.2 Dark Earth
HB.12 Mid Stone
HB.13 Azure Blue
HB.10 Night Black
HB.11 Underside White
HB.14 Airframe Silver

KIT 6
FRENCH AIR FORCE
HF.1 Kaki (Khaki)
HF.2 Vert (Green)
HF.3 Terre Foncee (Dark Earth)
HF.4 Gris Bleu Clair (Lt Blue Grey)
HF.5 Gris Bleu Fonce (Dk Blue Grey)
HF.6 Chocolat (Chocolate)

KIT 7
ITALIAN AIR FORCE
HI.1 Mottle Green
HI.2 Upper Green
HI.3 Overall Green
HI.4 Sand
HI.5 Grey
HI.6 Insignia White

KIT 8
JAPANESE AIR FORCE
HJ.1 Green N.1
HJ.2 Grey A/N2
HJ.3 Green A.3
HJ.4 Mauve N.9
HJ.5 Brown N.17
HJ.6 Silver A.6

KIT 9
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HU.7 Green 34079
HU.8 Green 34102
HU.9 Tan 30219
HU.10 Grey 36622
HU.11 Airframe White
HU.12 Night Black

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HM.1 8th Army Desert Yellow
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HM.3 U.S. Olive Drab
HM.4 German Panzer Grey
HB.1 Dark Green
HB.2 Dark Earth

KIT 11N
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HN.1 Light Grey
HN.2 Dark Grey
HN.3 Deck Green
HN.4 Deck Bleached Teak
HN.5 Hull Red
HN.6 Black

KIT 12
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HG.8 German Green
HG.9 German Purple
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HM.10 Navy Blue
HM.11 Black

22 CEREMONIAL UNIFORMS
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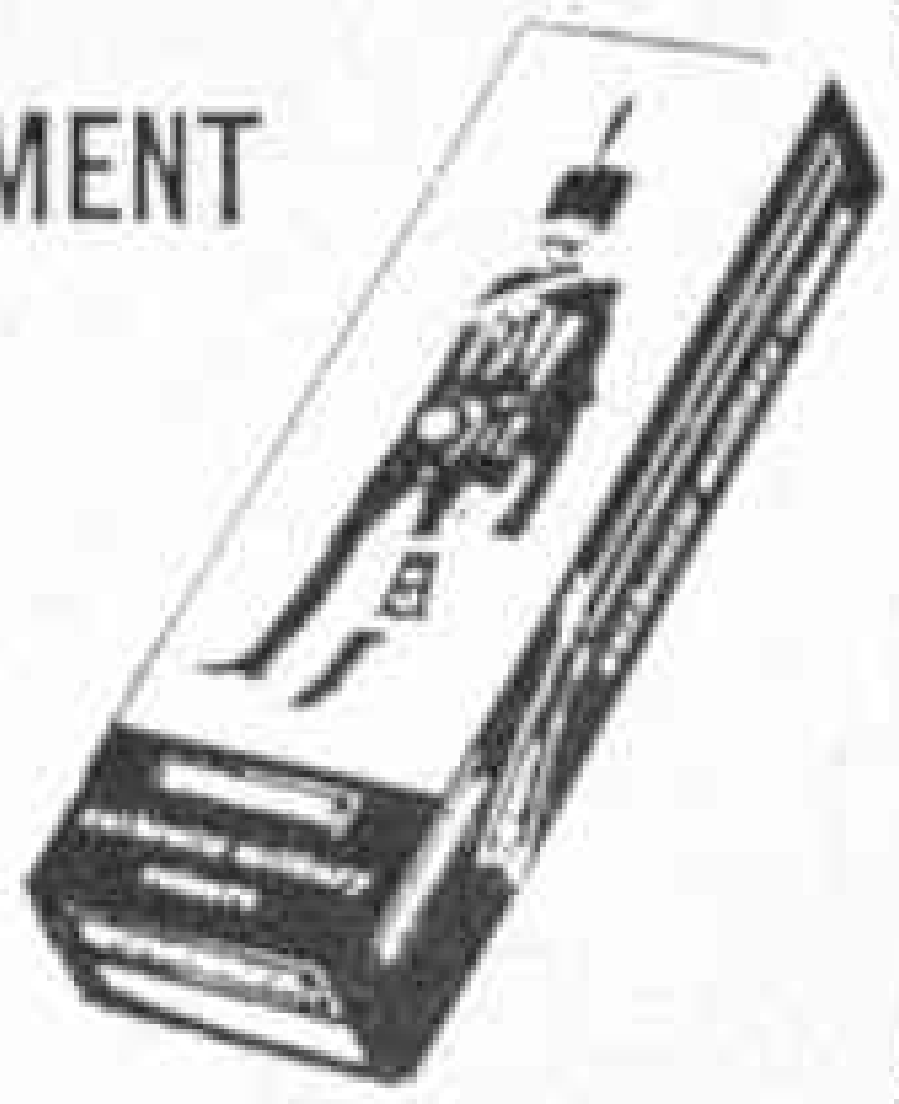
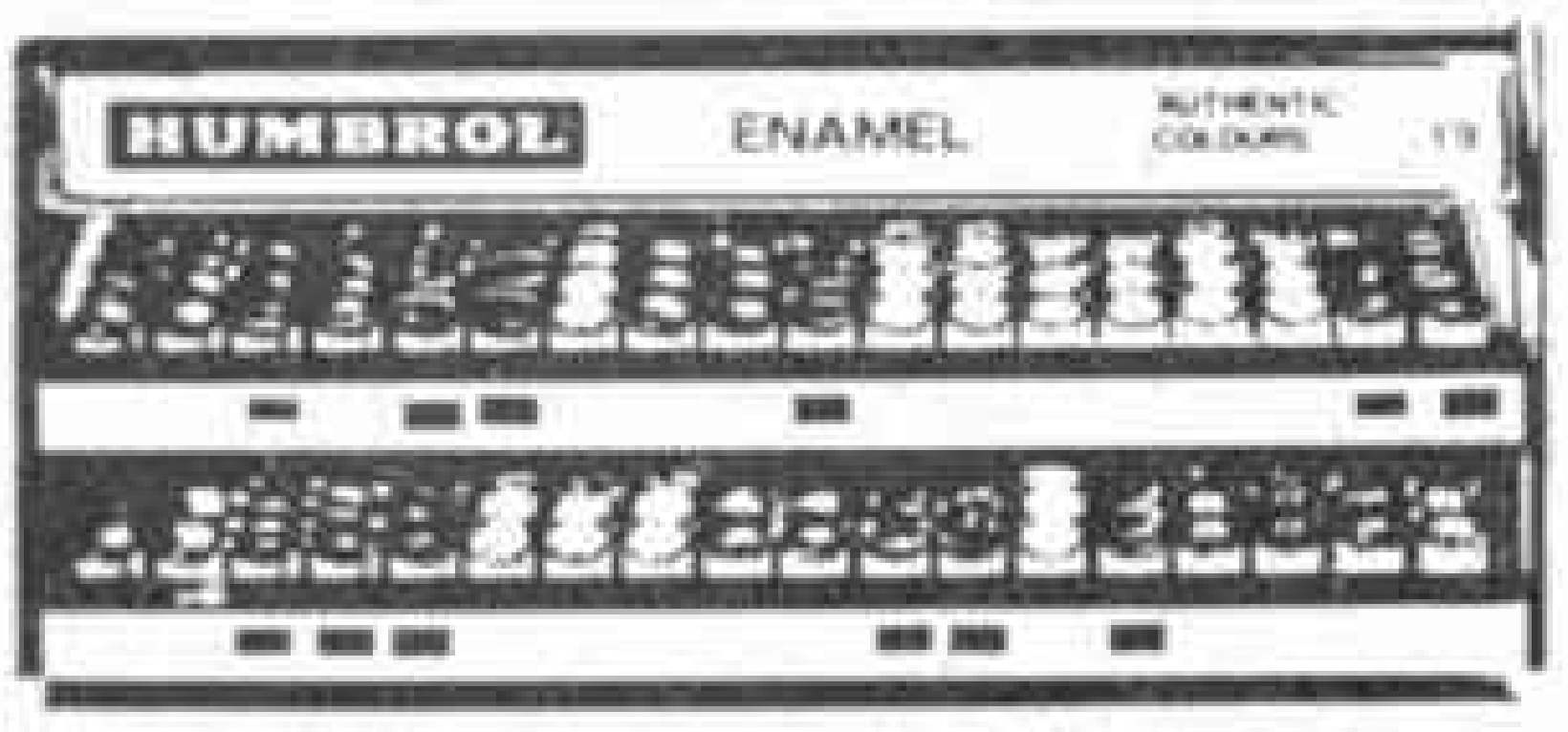
HM.12 Dark Blue
HM.13 Dark Green
HM.14 White
HM.15 Flesh
HM.16 Crimson

23 MILITARY EQUIPMENT
HM.17 Gun Metal
HM.18 Brass
HM.19 Dark Wood
HM.20 Silver Plate
HM.21 Leather
HM.11 Black





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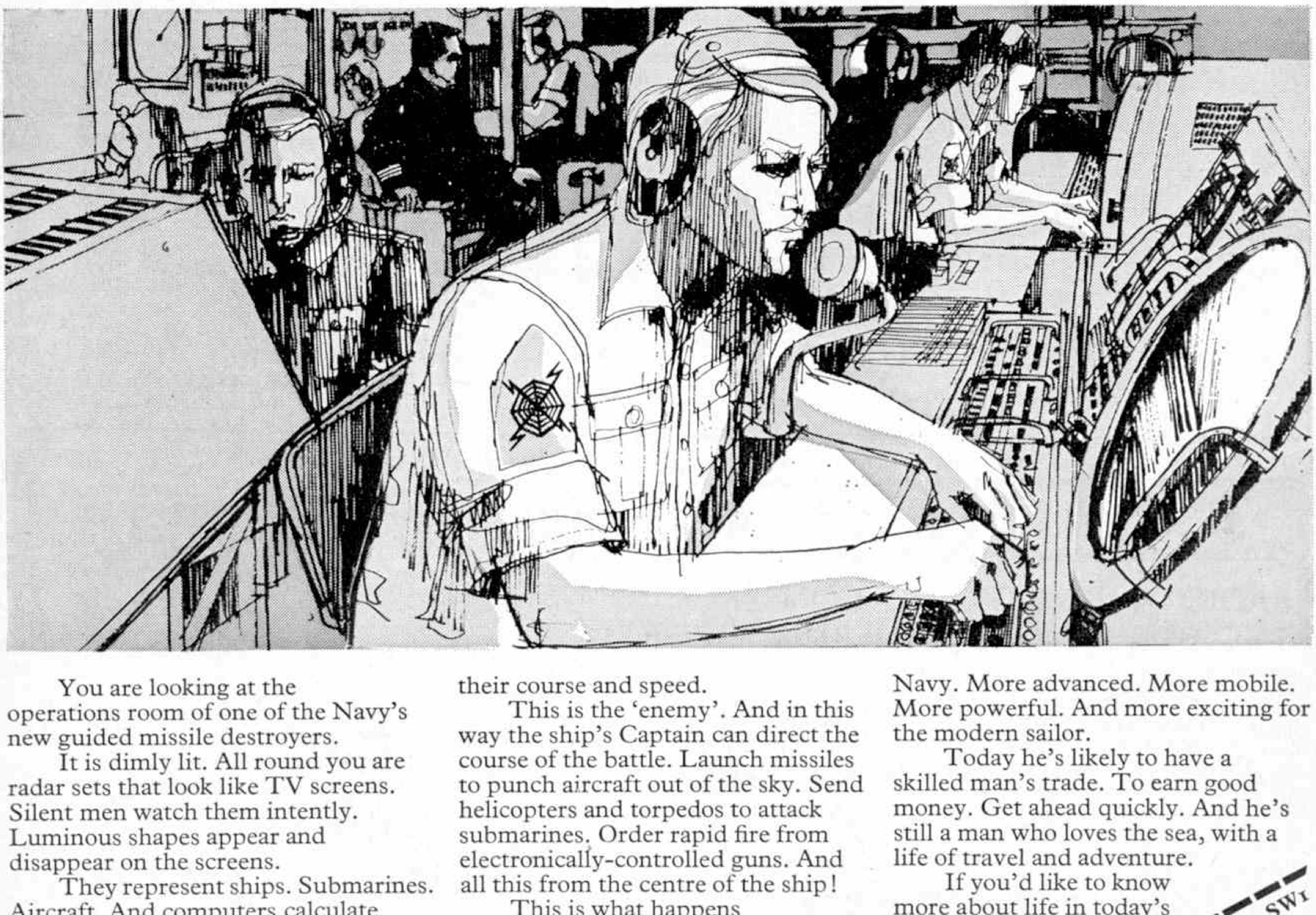

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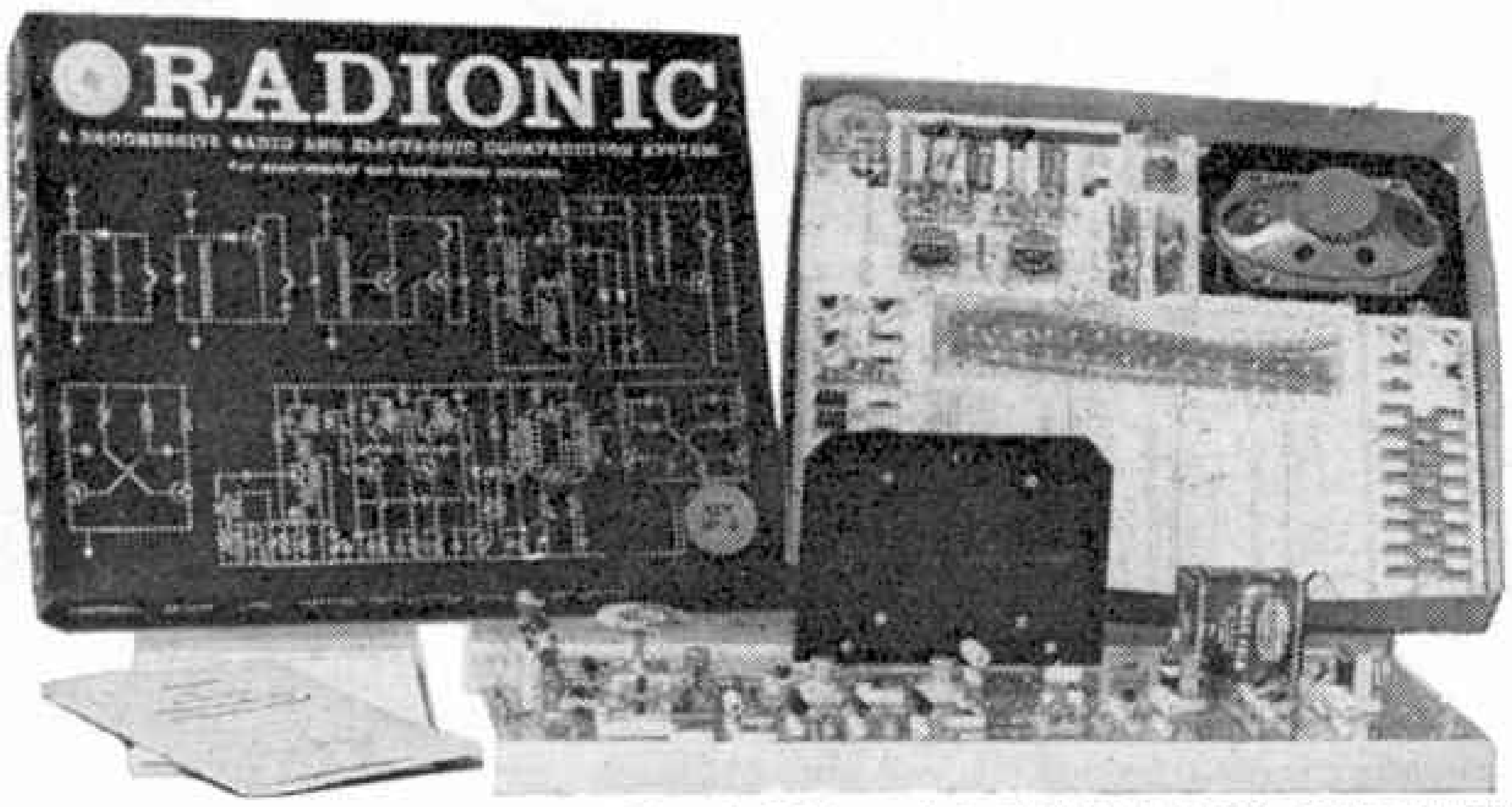

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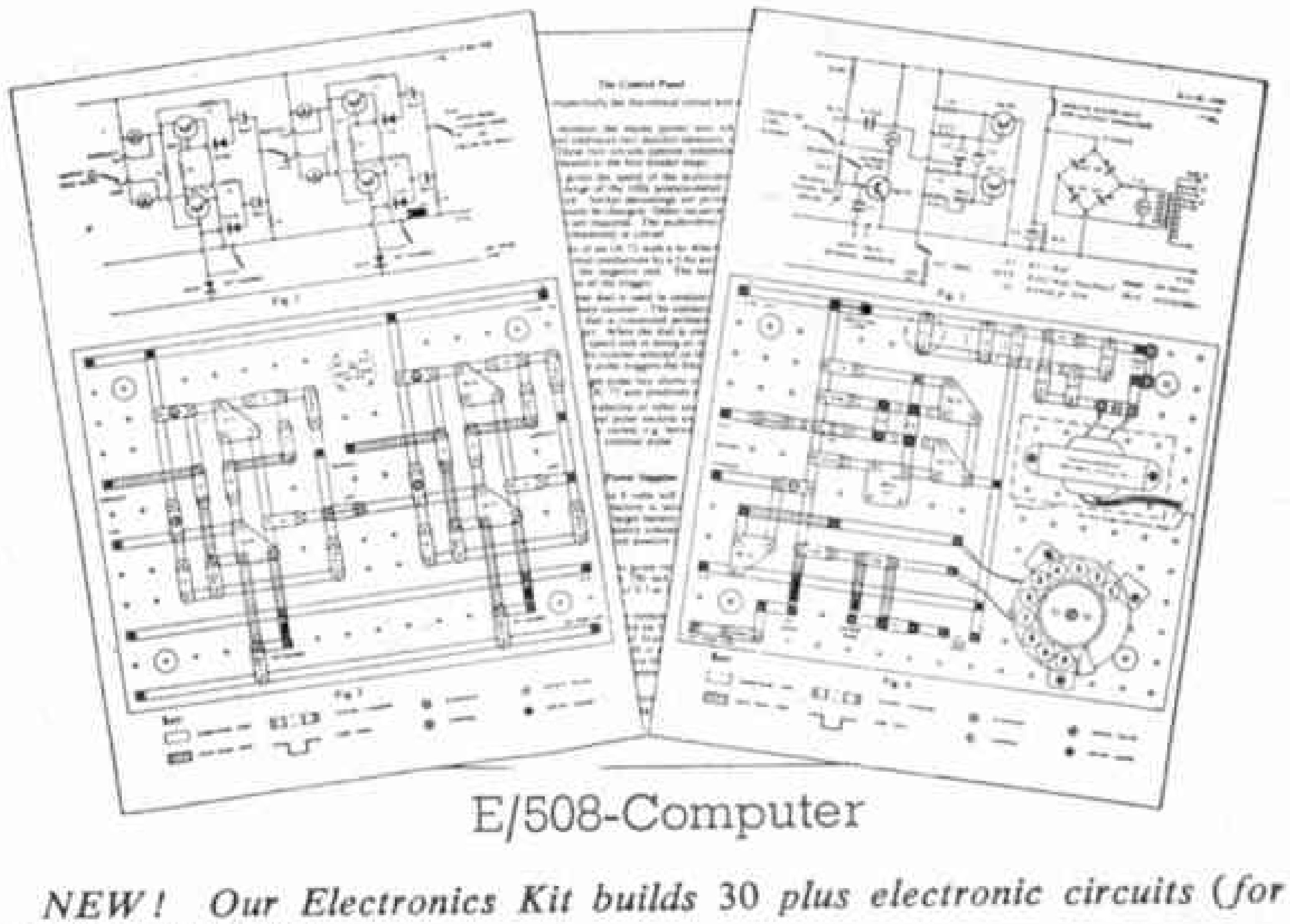

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WORKBENCH

Gigantic Meccano Models

THE MECCANO model building department in Liverpool have recently finished working on the tallest Meccano display model ever built, to the best of our knowledge, in the history of the system. The model in question is based on New York's Empire State Building and, together with a Meccano G.P.O. Tower model, it formed the centre-piece of the *Daily Mail*-organised " New Year Show " held at Olympia from December 27 last year until January 11 this year.

The theme of the show was 50 years of transatlantic flight, it being half a century since Alcock and Brown made the first air crossing of the Atlantic in a Vickers Vimy, flying from Newfoundland to Clifden, Ireland on June 14-15, 1919. In May this year to commemorate Alcock and Brown's flight, the *Daily Mail* are sponsoring another great transatlantic race from the top of the G.P.O. Tower in London to the top of the Empire State Building in New York, and visitors to the New Year Show will know that this is where the two Meccano models came in. They were used by the exhibition organisers to publicise the forthcoming race—and they were certainly successful, thanks not only to their colourful appearance, but particularly to their size. At 14 ft the existing G.P.O. Tower model was dwarfed by the colossal Empire State Building which, to conform to scale, had to rise some 32 ft. from its base to the tip of its radio mast and, for a Meccano model, that's some height!

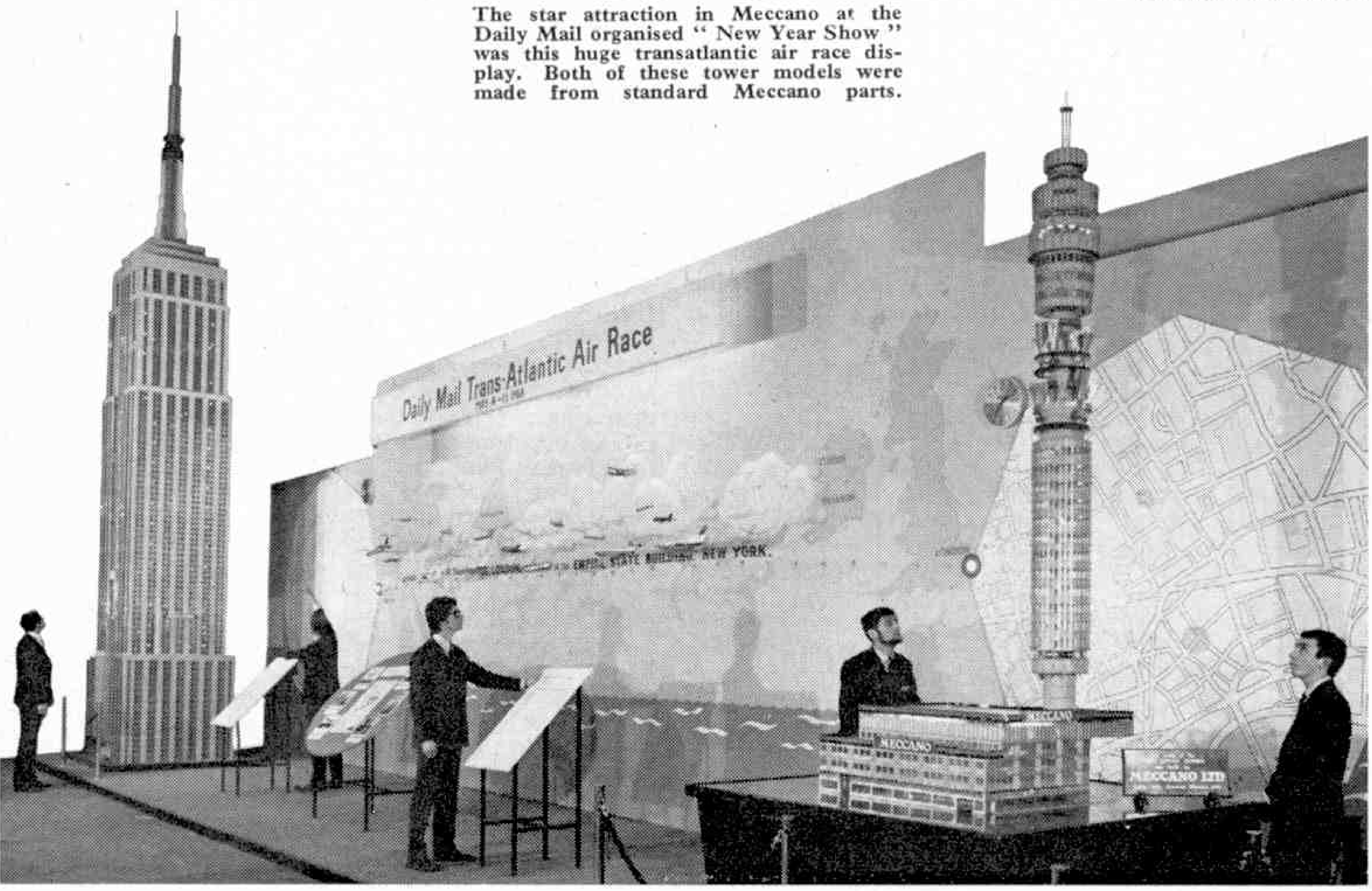
It involved rather a lot of work, as well. In fact a team of five model-builders used an estimated 100,000 parts, including almost 400 lights, in its construction. It took the team a month to complete, working full-time on the one job, under the guidance of Mr Bob Moy, head of Meccano Limited's Model-Building Department. When it was finished, it was so big that it couldn't be assembled inside the model-building workshop, but had to be built in twelve sections, and assembled " on site " at Olympia. The three largest sections were first joined together side to side to form the base and the two shoulder pieces added. The other seven sections which included the tower piece and radio aerial were then bolted up on the floor in the vertical position and lifted and moved into position by overhead travelling pulleys. In all, some 380 lights are used to illuminate the Empire State Building and it weighs around 6 cwt. It is free standing and can support the weight of several people standing on top of it! Some idea of the enormous size of the model can be had from the photograph with the visitor at its base.

A schoolboy dream comes true

One of those romantic stories which, it seems, only philately can provide, was recalled when the 1954 Kenya 5c. ' centred inverted ' was auctioned by Stanley Gibbons Ltd. on December 12th.

The stamp, which is believed to be unique and the greatest rarity of the present reign, was found by a sixteen year old schoolboy in New Jersey, U.S.A., when glancing through an approval book. He needed the 5c.

Continued on page 129


Daily Mail Trans-Atlantic Air Race
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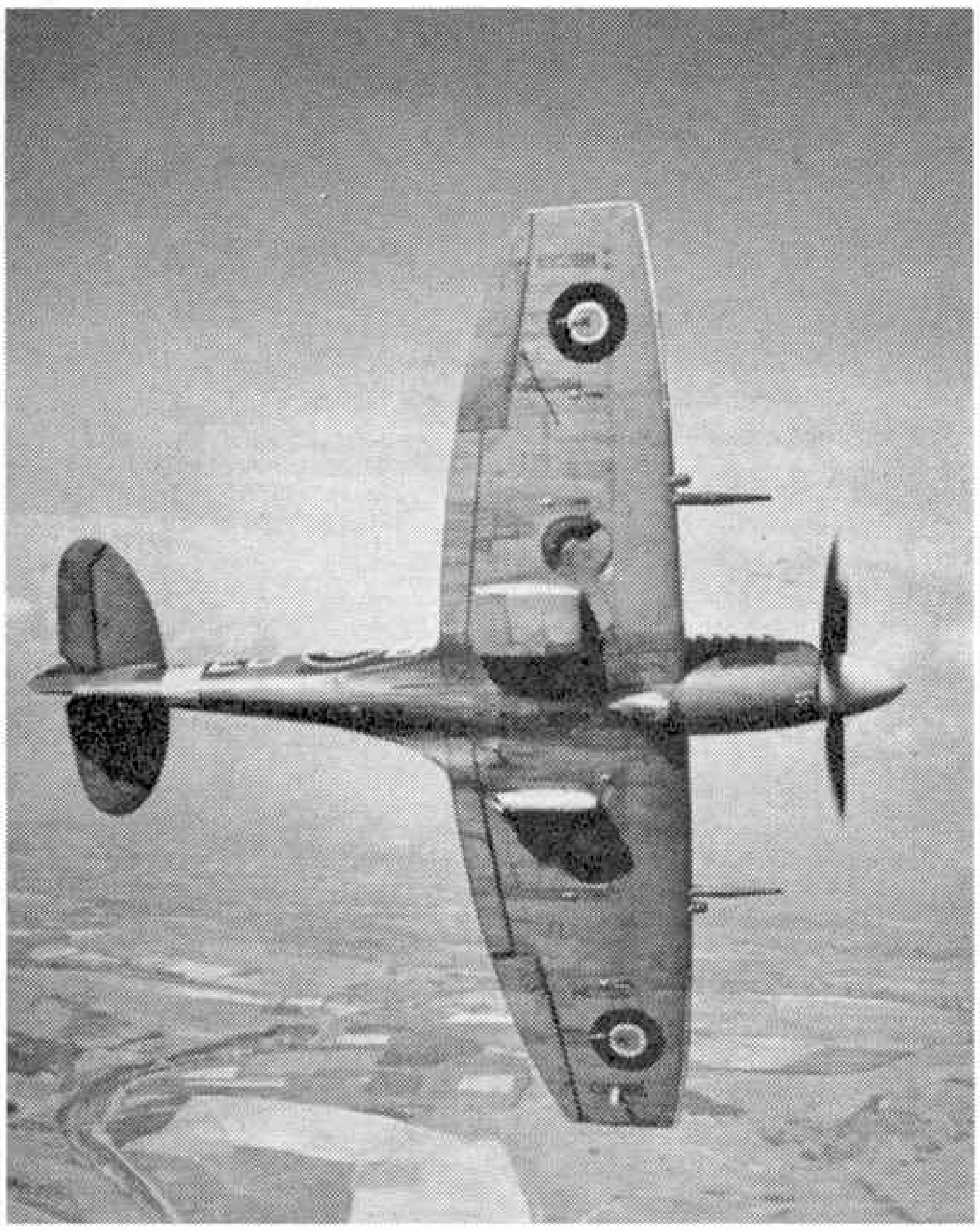
The star attraction in Meccano at the Daily Mail organised " New Year Show " was this huge transatlantic air race display. Both of these tower models were made from standard Meccano parts.



THE BRITISH TOY THAT BEAT THE LUFTWAFFE

John W. R. Taylor describes the historical events that led up to the design and development of the most famed fighter aircraft of all time—the Supermarine Spitfire.

At left: The first of the Griffon-engined Spitfires, the Mk XII had clipped wings to increase its speed at low altitudes. Below: The Schneider Trophy. Lessons learned in winning this helped to make the Spitfire an outstanding fighter. The Supermarine S.6B, winner of the Schneider Trophy, first aircraft to set up an over 400 m.p.h. speed record, and ancestor of the Spitfire.

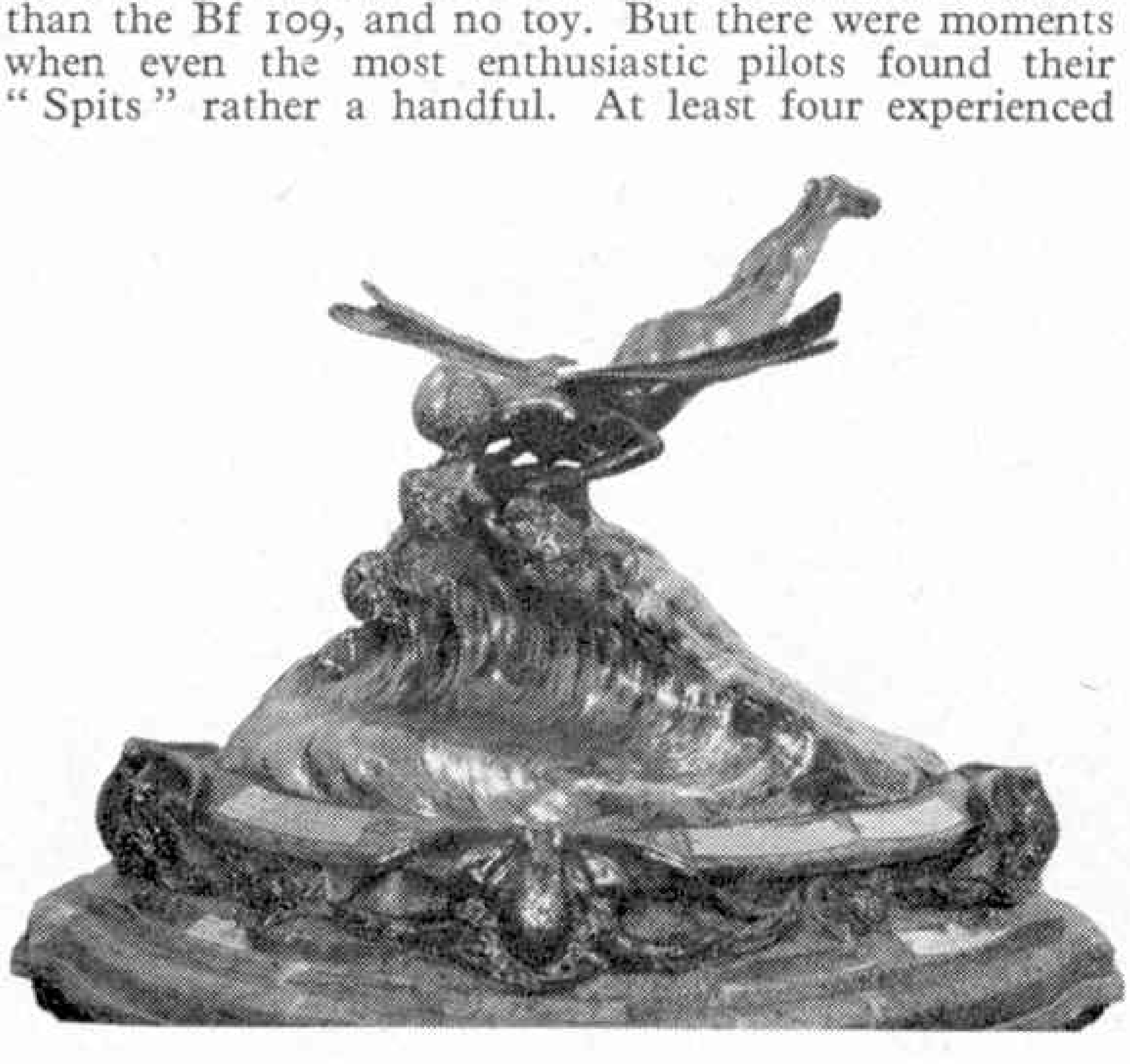
THE AIR Attaché from the German Embassy in London was not impressed when he saw a Spitfire for the first time, at an air display in June 1936. Accustomed to the more angular, aggressive lines of *Luftwaffe* warplanes, he refused to believe that anything so small and dainty as the Spitfire could be a hard-hitting fighter, and referred to it as a toy.

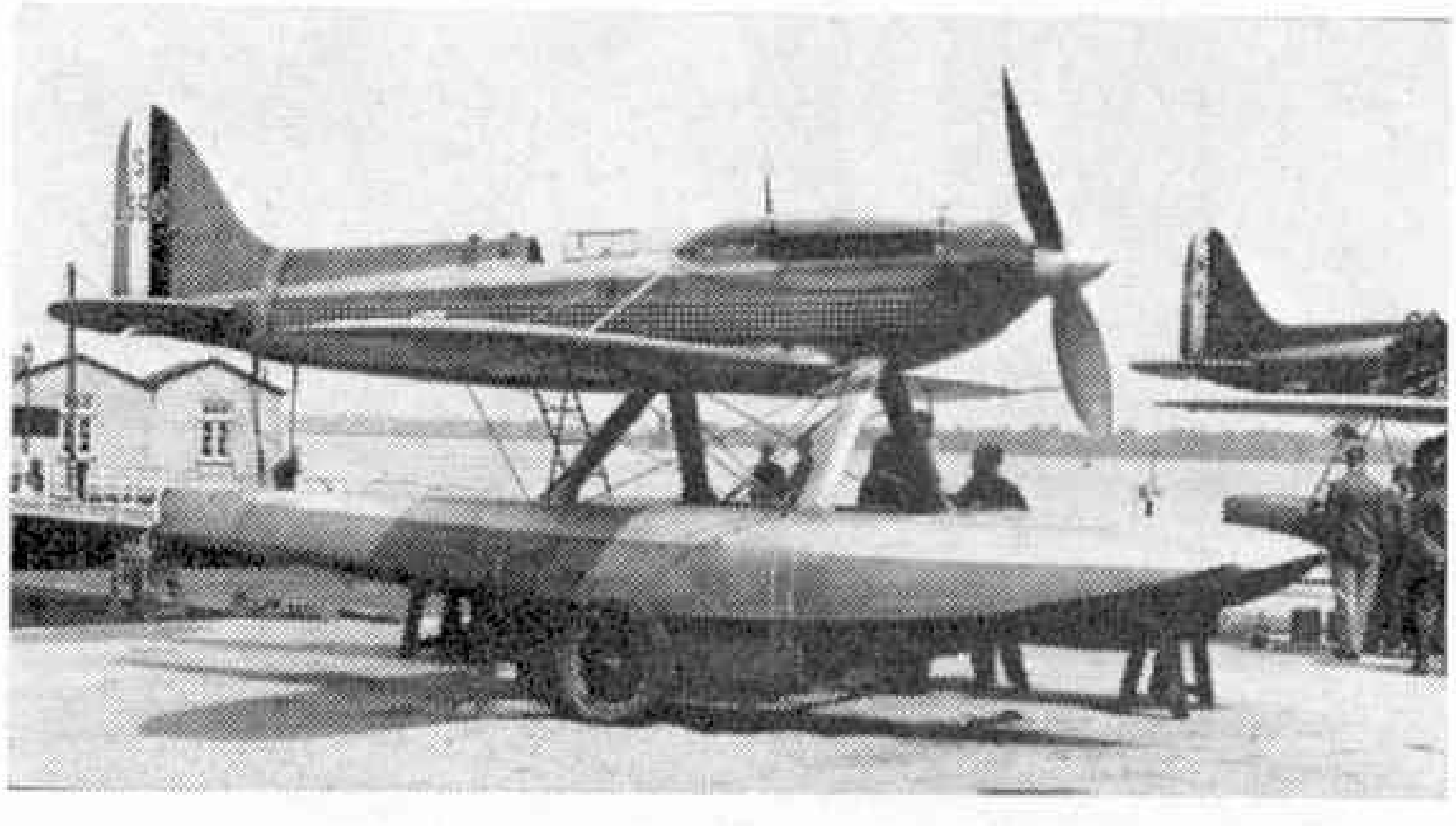
Major Alexander de Seversky, the famous American designer, was a little more enthusiastic. After flying both a Spitfire and a Messerschmitt Bf 109 in the summer of 1939, he wrote that the British fighter seemed the better of the two, but was more difficult to maintain and not so fast as the Bf 109.

The R.A.F. knew, and the *Luftwaffe* was soon to discover to its cost, that the Spitfire was really faster than the Bf 109, and no toy. But there were moments when even the most enthusiastic pilots found their " Spits " rather a handful. At least four experienced pilots, brought up on biplanes with a fixed undercarrige, forgot to lower their wheels when landing and ended up feeling rather foolish, surrounded by a bent aeroplane.

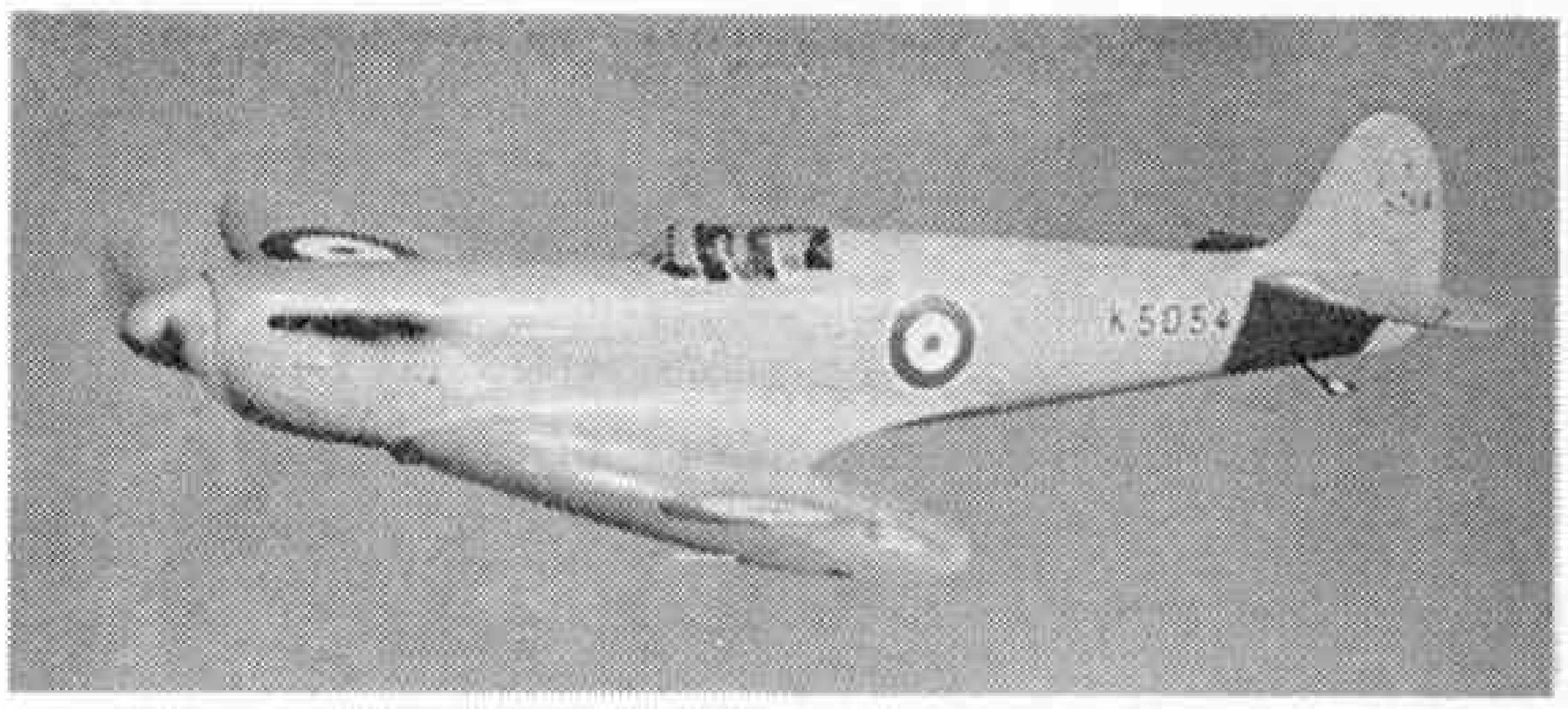
One sergeant-pilot at Duxford did this in front of a huge crowd at the 1939 Empire Air Day display. Intent on winning a spot-landing competition, he touched down bang (literally !) on the spot marked on the airfield, with his wheels still retracted. Right up to the last moment, the public thought it was a prearranged stunt and that the airmen who dashed on to the airfield, waving their arms in a desperate but vain atempt to attract the pilot's attention, were all part of the act. Instead of winning the prize, the unfortunate sergeant was fined £5 for negligence.

For the R.A.F. such accidents were serious. War with Germany seemed more and more likely, and Fighter Command needed every aircraft it could get. But the Spitfire's high performance stemmed from the fact that it was a highly-advanced design, with a complicated wing structure and an all-metal semimonocoque rear fuselage, and deliveries were at the rate of only one aircraft a week, at first. By comparison, the Hawker Hurricane was much easier to build, as its





K5054, the Spitfire prototype, which flew for the first time on March 5th, 1936. Note the very much changed lines of the Mk 5 and Mk 9 on the cover.



construction differed little from that of the biplane fighters it replaced; but it was slower than either the Spitfire or the Bf 109.

Looking back, after nearly thirty years, we realise that it was these differences between the British fighters, rather than their many similarities, that enabled the R.A.F. to win the war in the air.

Sufficient Hurricanes had been delivered by the start of the Battle of Britain to equip 29 squadrons, compared with 19 Spitfire squadrons. Had there been only 19 squadrons of each, the outcome of the battle might have been very different. In the years that followed, the Hurricane was switched to specialised duties such as ground attack and anti-tank operations, armed with bombs, rockets and even a pair of 40-mm. cannon as big as Bofors anti-aircraft guns. In this way, it was able to play a major role in defeating Rommel's armour at Alamein and the Japanese in India and Burma, without having to match itself too often against later, much improved enemy fighters.

The Spitfire, on the other hand, became a better and better fighting aircraft as the war progressed. It ended up with an engine more than twice as powerful as that with which it started, a top speed nearly 100 m.p.h. higher and a tremendously increased fire-power, enabling it to hold its own against the best enemy piston-engined machines.

It is wrong for anyone to suggest that the Spitfire was better than the Hurricane, or vice versa. The R.A.F. had the right numbers of each type, in the right place at the right time, often doing different jobs, and together they made the greatest fighter team of World War II.

To learn the secret of the Spitfire's long life and high performance, we have to go right back to 1922. On 12th August that year, a British Supermarine Sea Lion flying-boat won the sixth contest for the coveted Schneider Trophy. Had it not done so, the Italians would have gained a third consecutive victory and the Trophy would have been theirs for keeps; in which event their might never have been a Spitfire.

Supermarine's brilliant young chief designer, Reginald Mitchell, knew that the clumsy-looking Sea Lion would not be good enough to win again. It put a good show in 1923, but the contest was won by an American Curtiss seaplane. The engine installation and floats of the winning machine were so neat and well-streamlined that the whole aircraft had a very small frontal area. Mitchell learned a lot by studying these features of the Curtiss, but already knew how to produce something far better.

Like the Sea Lion, the Curtiss was a biplane. The racer he wanted to build would be a small, incredibly " clean " cantilever monoplane—the smallest seaplane, in fact, that could be designed around a 700 h.p. Napier Lion engine, with no wing struts, bracing wires or unnecessary bumps to reduce its speed.

The Supermarine directors had such faith in Mitchell's ability that they gave him a free hand to develop his revolutionary aircraft. There was no contest in 1924. By March 1925, Mitchell and his design team had completed the drawings of the racer, known as the Supermarine S.4. It was built in only five months and flew in August. On 13th September, it set up a world seaplane record of 226 m.p.h., proving itself the fastest aircraft built in Britain up to the time.

Before it could compete in the 1925 Schneider contest, the S.4 developed wing flutter and crashed; but nobody doubted any longer that Mitchell's ideas could produce a world-beater. Up to that time, Supermarine and Napier had borne the whole cost of building and flying the aircraft they entered in the Schneider Trophy contests, despite the fact that most of the foreign entries were heavily subsidised. Victory in the contest had assumed such importance that the prestige of entire national aircraft industries hung in the balance at each race. The British government could no longer stand aloof and ordered seven specially-built high-speed seaplanes, of which three were to be improved versions of the S.4.

It is hardly necessary to recall what followed. A Supermarine S.5 won the 1927 contest at a speed of 281.6 m.p.h. Two years later the S.6 not only repeated the success but set up a new World Speed Record of 357.7 m.p.h. There were no contests in 1928 and 1930, so when an S.6B won the 1931 event Britain gained the Trophy outright. Shortly afterwards, another S.6B raised the World Speed Record to 407.5 m.p.h., becoming the first aircraft ever to exceed 400 m.p.h.

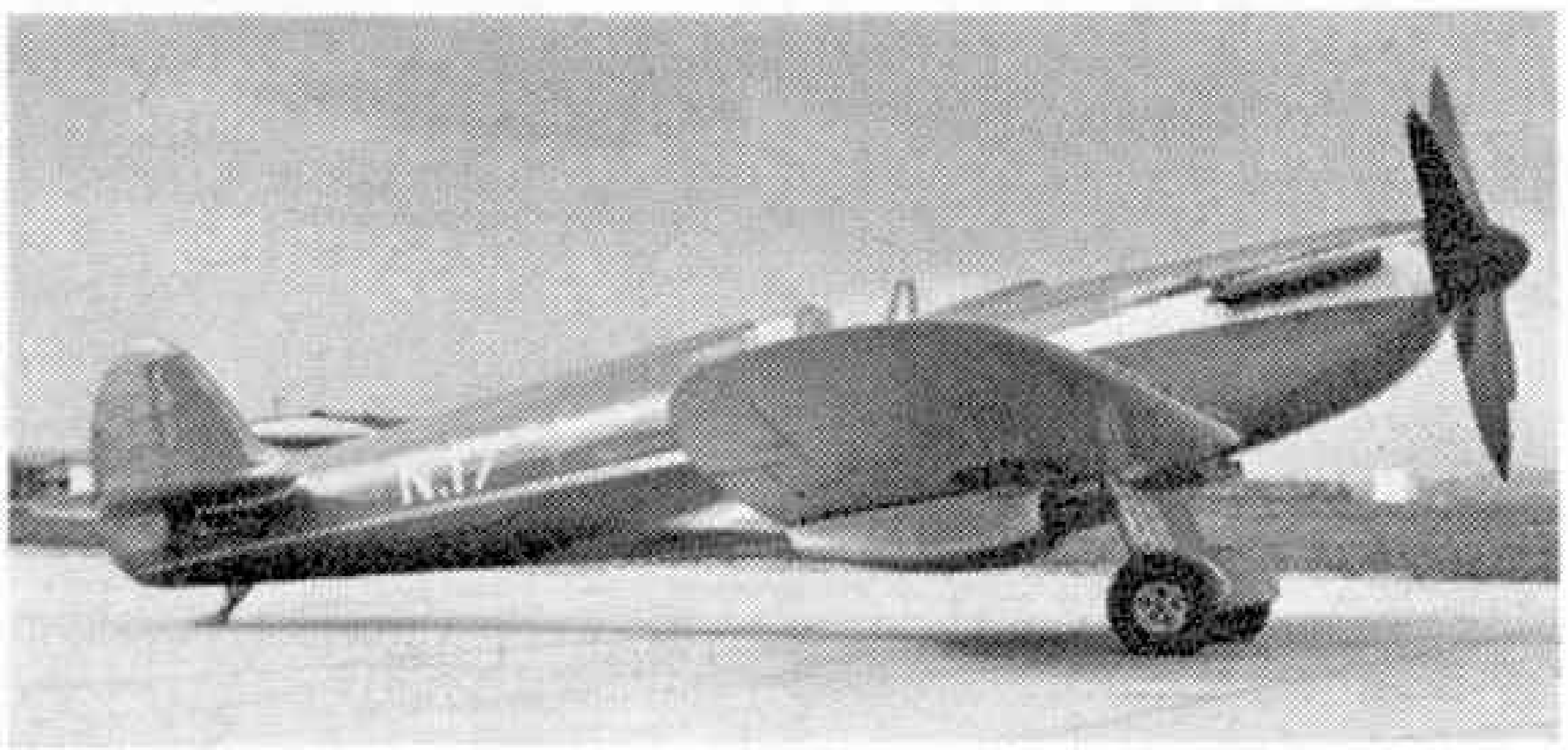
The S.6B was a remarkable aircraft, powered by a Rolls-Royce engine giving no less than 2,300 h.p. Although its racing days were over and its job done, it had pioneered many new ideas in the design and construction of airframes and earo-engines, and Mitchell wasted no time in making use of the experience gained.

When the Air Ministry issued Specification F7/30, outlining the kind of fighter they needed to re-equip the R.A.F., he produced a design based as closely as possible on that of the S.6B. Unfortunately, the Specification recommended use of the 660 h.p. Rolls-Royce Goshawk, which proved to be one of the few disappointing products of the world's greatest aero-engine company. Mitchell's F7/30 had a top speed of only 230 m.p.h. and none of its competitors, produced by other firms, showed any greater promise; so the Air Ministry decided to abandon them all and ordered instead the Gladiator, a conventional radial-engined biplane based on the well-proven Gloster Gauntlet.

However, Specification F7/30 was not a complete failure. It inspired British designers to be more adventurous and led to a doubling of the fire-power of R.A.F. fighters which, until then, had continued to carry the same two Vickers machine-guns as their predecessors of World War I.

Having discovered the shortcomings of official specifications, Mitchell and his counterpart at Hawkers, Sydney Camm, decided to design the sort of fighters they thought the R.A.F. should have. The results, in due course, were the Spitfire and Hurricane, evolved in very similar ways.

Mitchell began by replacing the big-span " inverted gull " wing of the F7/30 with a more conventional wing. He added an enclosed cockpit for the pilot and drew a retractable undercarriage in place of the " trousered " main wheels of the F7/30. By this time, there had been two important developments. The Air



The Speed Spitfire built in 1939 for an attempt on the World Speed Record.

Ministry had issued Specification F5/34, calling for a fighter very like Mitchell's new machine, with an armament of six or eight machine-guns, a reflector gun-sight, retractable undercarriage, wheel-brakes, enclosed cockpit, an oxygen system for the pilot, and a performance which included a ceiling of 33,000 feet and speed of 275 m.p.h. at 15,000 feet. Rolls-Royce had under test an engine that would make such a performance possible; known as the PV-12, it gave promise of 1,000 h.p. and was to become, in due course, the Merlin.

Mitchell refined his design, found room for eight guns inside its thin, elliptical wings, replaced the original Goshawk with the PV-12, and submitted the design to the Air Ministry. They were so impressed by it that they issued a new Specification, F37/34, based on the Supermarine fighter, and ordered a prototype, with the serial number K5054. Work began in January 1935 and K5054 made its first flight on 5th March 1936. The Spitfire had been born.

From the start there was no doubt that Mitchell had produced an outstanding fighter. Finished in highly-polished cream seaplane enamel, it could fly at 349 m.p.h. and handled beautifully. On 3rd June, only three months after the prototype left the ground, the Air Ministry ordered 310 Spitfire Mk.Is, little realising that by the time the last "Spit" came off the line in October 1947 production would total an incredible 20,351, to which must be added 2,408 Seafire naval fighters.

Few advanced aircraft are easy to put into production and service, and the Spitfire presented its share of problems. The relatively new stressed-skin fuselage construction required expensive jigs and tools and the distinctive elliptical wings were far less simple to manufacture than a rectangular or tapered wing. In the end, a total of 339,400 man-hours of design work went into the Spitfire Mk.I and no fewer than 800,000 man-hours were required to produce the jigs and tools on which it was built.

This was only the start. Between 1938, when the first Spitfires were delivered, and the end of the war in 1945, nearly 1,100 major changes were made to the design and countless minor modifications. Altogether, nineteen basic new Marks were evolved, each requiring anything from 3,685 to 168,500 additional design man-hours and up to a quarter of a million man-hours on jig and tool work. This was part of the cost of keeping the Spitfire in the front line. The cost in terms of money was astronomical.

Reginald Mitchell never saw a production Spitfire. He died on 11th June 1937, when he was only 42 years old, but he left his little fighter in the capable hands of "Joe" Smith—another of Britain's truly great aircraft designers.

What a fighter it was. The standard Mk.I Spitfire had a top speed of 355 m.p.h. at 19,000 feet when powered by a 1,030 h.p. Merlin II engine. Its eight Browning guns were installed in the wings, outside the propeller "disc", so that any aircraft caught in a two-second burst of concentrated fire was shattered by 276 bullets.

Supermarine felt confident that they had the finest fighter in the sky; they decided to prove that they also had a basic design able to outfly any aeroplane ever built, by setting up a new World Speed Record. The 48th production airframe, K9834, was fitted with a specially-boosted 2,160 h.p. Merlin III engine. Its wing span reduced from 36 ft. 10 in. to 33 ft. 8 in., a more streamlined cockpit hood was fitted and other changes were made, with the idea of making possible a speed of at least 410 m.p.h. Before the Speed Spitfire was ready for its attempt, the Germans set up a new record of 469.22 m.p.h. in a Messerschmitt Me 209, which has not been beaten to this day by any piston-engined aircraft.

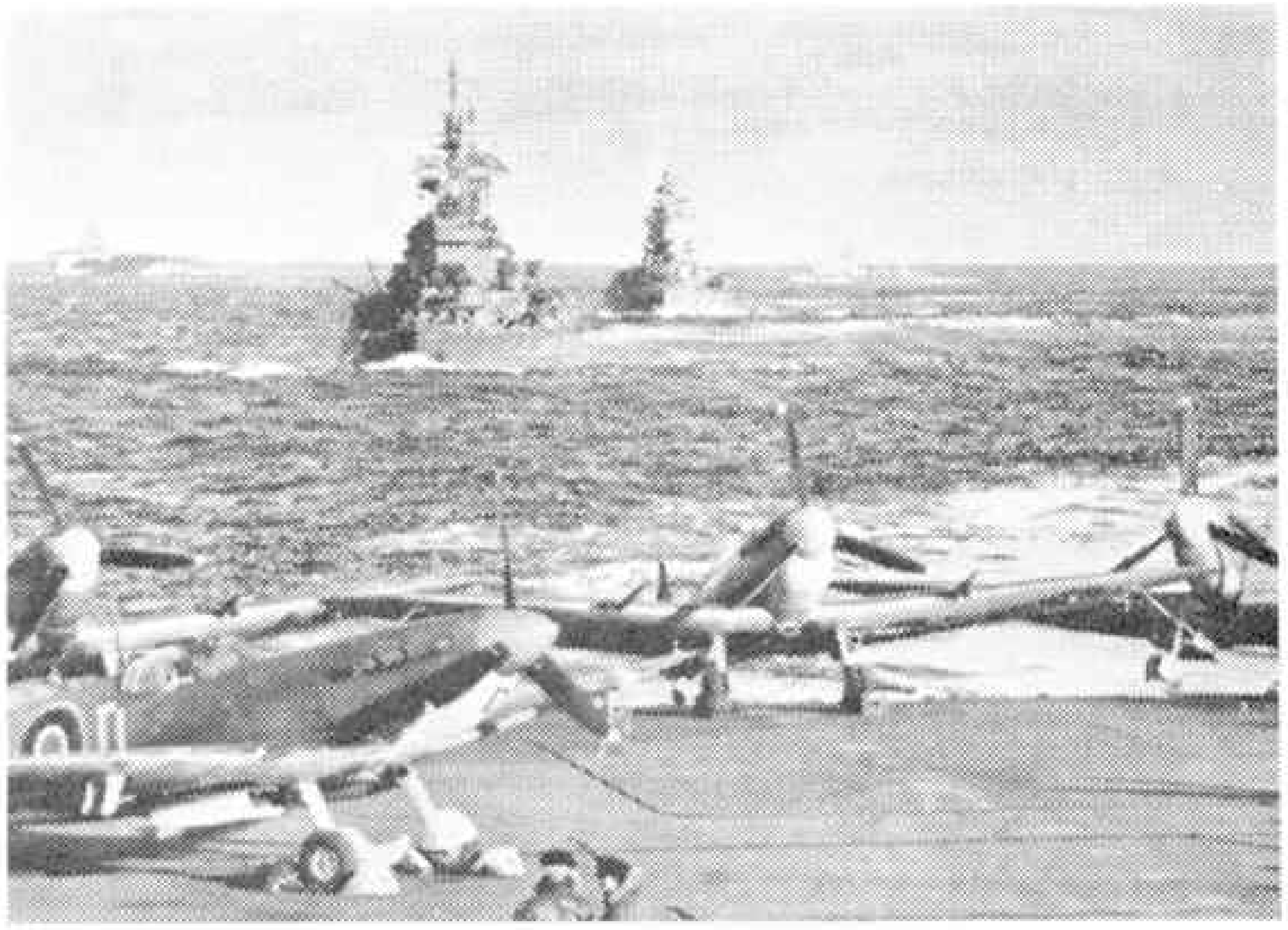
There was no time to feel disappointed. War was near and Spitfires were at last flowing off the assembly lines in satisfactory numbers. Supermarine was by now a division of Vickers-Armstrongs Ltd., and the vast production resources of this great company were supplemented by a huge "shadow factory" built at Castle Bromwich for operation by the Nuffield Organisation (Morris cars). Before long Westland Aircraft and innumerable subcontractors were brought into the programme to meet Fighter Command's ever-growing demands.

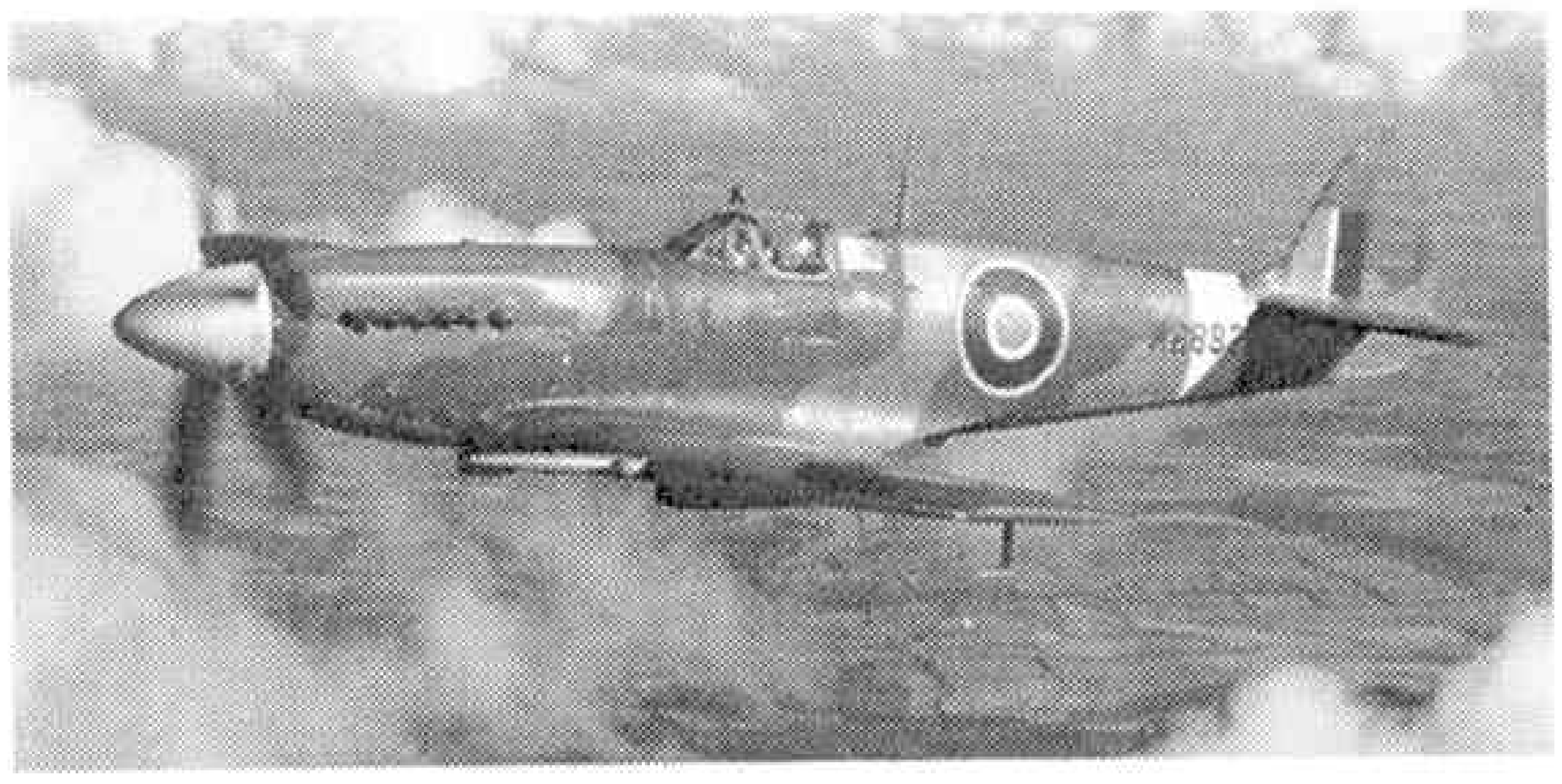
The war was six weeks old when Spitfires made their first kills. On 16th October 1939 fourteen Dornier Do 215 and Heinkel He 111 bombers attacked the Forth Bridge and warships at anchor nearby. Nos. 602 and 603 squadrons each destroyed an He 111, and these were the first German aircraft shot down over Britain since 1918. If Hitler had realised how many more would be added to the tally in the Battle of Britain, in the summer of 1940, he would never have started it.

It is usually claimed that during the Battle the Hurricanes tackled the German bombers while the Spitfires dealt with the higher-flying Bf 109 fighters that were supposed to protect the bombers. This may have been the idea, but it seldom worked in practice, as there was not usually time to form up a balanced force of the two types of British fighters to launch against a particular attack. Everything with black crosses on its wings and fuselage and swastikas on the tail was fair game for both the Hurricanes and the Spitfires, and they swept the once-invincible *Luftwaffe* from the daylight skies over Britain in just seven weeks.

Britain, and the world, had been saved by about a thousand young men in R.A.F. blue—some speaking strange languages, for in addition to pilots from the Commonwealth many survivors of the Polish, Czech and other vanquished air forces escaped to fly and fight in Spitfires and Hurricanes. Between 10th July and 31st October, 1,733 German aircraft were destroyed, for the loss of 915 R.A.F. machines, and the *Luftwaffe* never recovered from the loss of so many of its best airmen.

After the Battle of Britain, it was inconceivable that this country would lose the war. As it dragged on for five more years, the Spitfire protected Allied ground and air forces almost everywhere they fought throughout the world. Huge sand filters were added under the graceful nose of aircraft flying over the deserts of North Africa. Arrester hooks and folding wings converted Spitfires into Seafires for operation from carriers of the Royal Navy. Two (and later four 20-mm. cannon were packed into the wings to increase fire-





Above: Another view of a Griffon-engined Mk X11 as shown in the heading photo. At left: Seafires on board a British carrier of Naval Force H, nearing the Algerian coast during the Allied invasion of North Africa in November 1942.

power, and bomb racks were fitted so that Spitfires could harrass ground targets when there were few enemy to fight in the air. Most important of all, the airframe was adapted to take the 1,735/2,050 h.p. Griffon engine—a direct descendant of the S.6B's racing engine—when this became available.

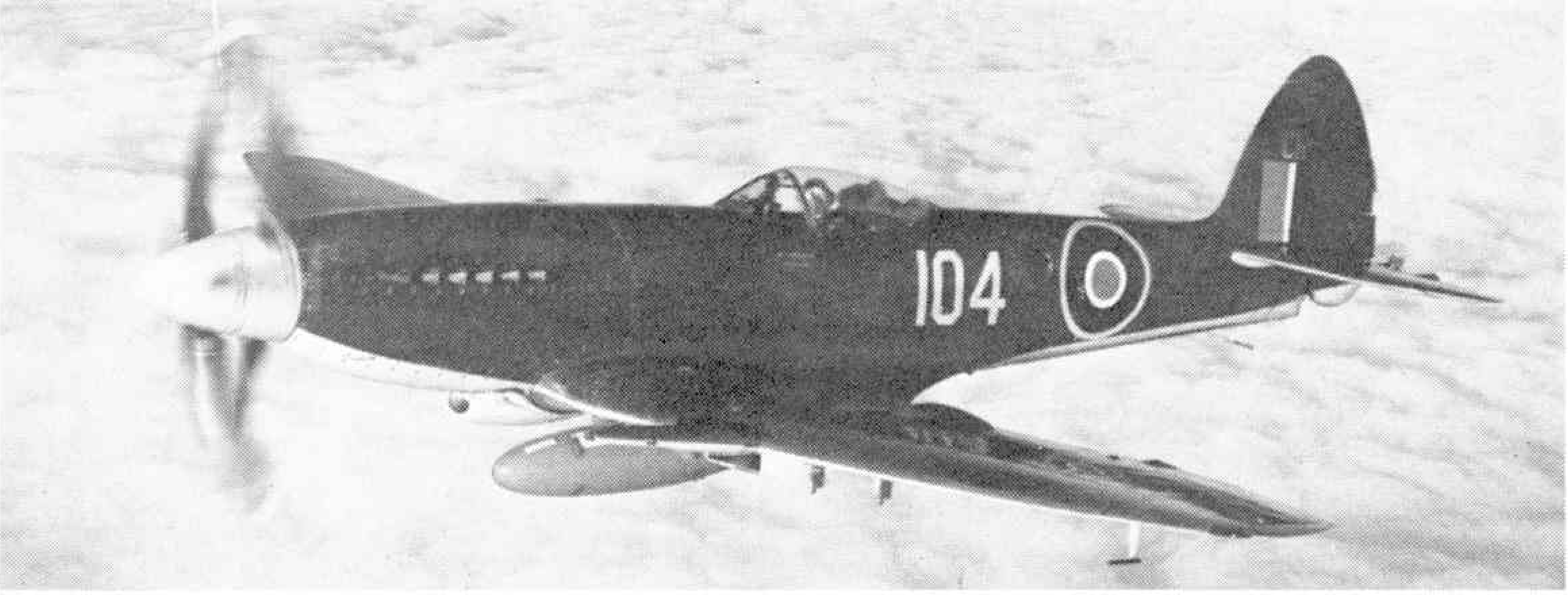
First version of the "Spit" fitted with a Griffon was the Mk.XII, and it came just in time. Earlier Marks were being outflown by the *Luftwaffe's* new Focke-Wulf Fw 190 fighter-bombers which were making regular hit-and-run raids on targets in Britain in 1942-43. Wingtip-to-wingtip with the Hawker Typhoon, the Spitfire XIIs soon remedied the situation. Their top speed was 393 m.p.h. at 18,000 feet, but they usually flew low and had the "clipped" squared-wingtips that identified versions intended for operation at low altitude. By comparison, Spitfires used at very high altitudes had extended and more pointed wingtips.

Not all Spitfires were used for fighting. In fact, some of the bravest of all Spitfire pilots were those who had no opportunity of firing at the enemy as their aircraft were unarmed. These were the men who flew deep into enemy territory on reconnaissance flights, searching out targets for Bomber Command and photographing the results of its raids. Relying on speed alone for defence, they usually flew very high; but some times the need for close-up pictures demanded a dash over a heavily defended target area almost at ground level.

Alone of all Allied fighters, the Spitfire remained in continuous production throughout World War II. The final versions, Marks 21, 22 and 24, had a new wing of different shape. In addition some Mark 21s had contra-rotating propellers, while the 22s and 24s had enlarged tail surfaces and "blister" type cockpit canopies. Some pilots claimed that these versions no longer looked like Spitfires, but they certainly behaved like "Spits". Even after Germany and Japan had been defeated, they still made life unpleasant for Britain's enemies in Malaya and elsewhere, while Seafires of the Royal Navy continued to operate against bandit hide-outs in Malaya and to play their part in the Korean War until 1950. Nor was this the end of the story, for many foreign air forces received and flew Spitfires, not least those of Russia and America, and some small nations kept their "Spits" in service long after the R.A.F. had re-equipped with jets.

Today the Spitfire is almost a legend. Glimpses of airworthy examples at air displays are becoming more and more rare; even the once-familiar "gate guardians" parked by the entrance to R.A.F. stations diminish in number year by year. But, in an age when some fighters cost £2½ million, we can still marvel at Reginald Mitchell's supreme creation, which was reckoned to cost a mere £5,000 in the wartime years when youngsters were proud to give pennies of their pocket money to "Spitfire Funds" and so help to buy the "toys" that beat the *Luftwaffe*.

The final version of the Seafire for the Royal Navy was the Mk 47, with a 2,375 h.p. Griffon 85 and contra-rotating propellers.



WHAT HEAT TRANSFER IS ALL ABOUT

by J. R. Simonson, Department of Mechanical Engineering, The City University, London.

EVERY DAY examples of heat transfer and heat insulation are found in any home. Water boiling in a pan on a gas or electric cooker involves *radiation* from the gas flame or radiant element to the pan, *conduction* in the wall of the pan, and *convection* to and in the boiling water. These three are the elementary processes of heat transfer. To reduce heat losses in the winter we insulate the roof and double glaze the windows. We keep food cold and fresh in a refrigerator, and we keep drinks hot in a thermos flask. These examples show that heat transfer is a natural phenomenon and that we wish to promote it in boiling the pan of water as quickly as possible, and to prevent it in insulating our houses, in keeping food in refrigerators, and hot drinks in thermos flasks.

The engineer uses the same natural phenomena of heat transfer, in many different industrial applications. Again he is concerned with either promoting or preventing heat transfer, both of which are limited by the materials at his disposal.

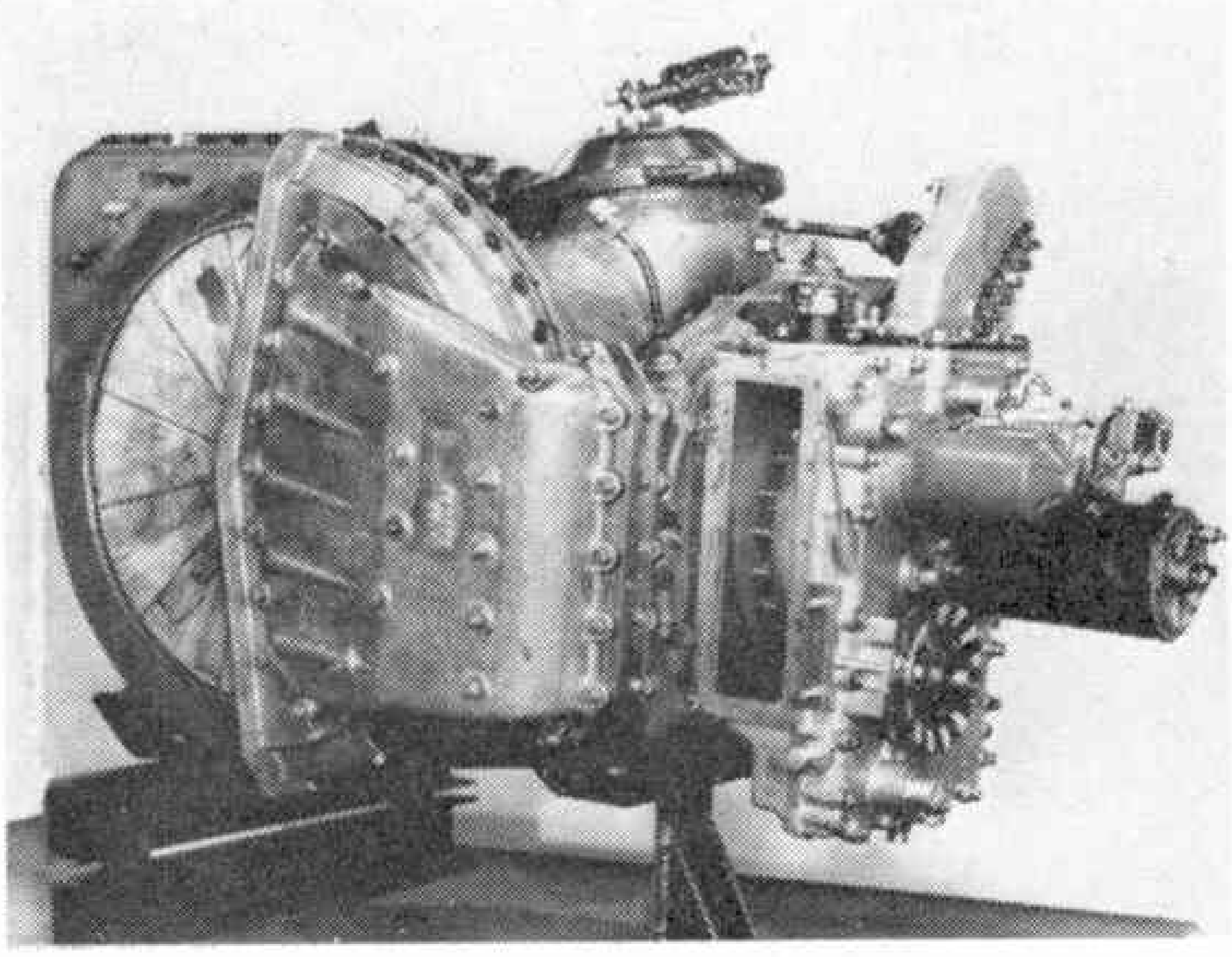
Historically, heat transfer processes were first put to practical use for power generation in the Newcomen engine built in 1712. Steam was raised in the boiler at atmospheric pressure in the same manner as in our example of a pan of boiling water. After the steam had filled the cylinder during the upward stroke of the piston, water was injected into the cylinder to condense the steam by conversion. This produced a vacuum and atmospheric pressure on the open side pushed the piston down again. The piston was raised by the overbalancing weight of the pump rods.

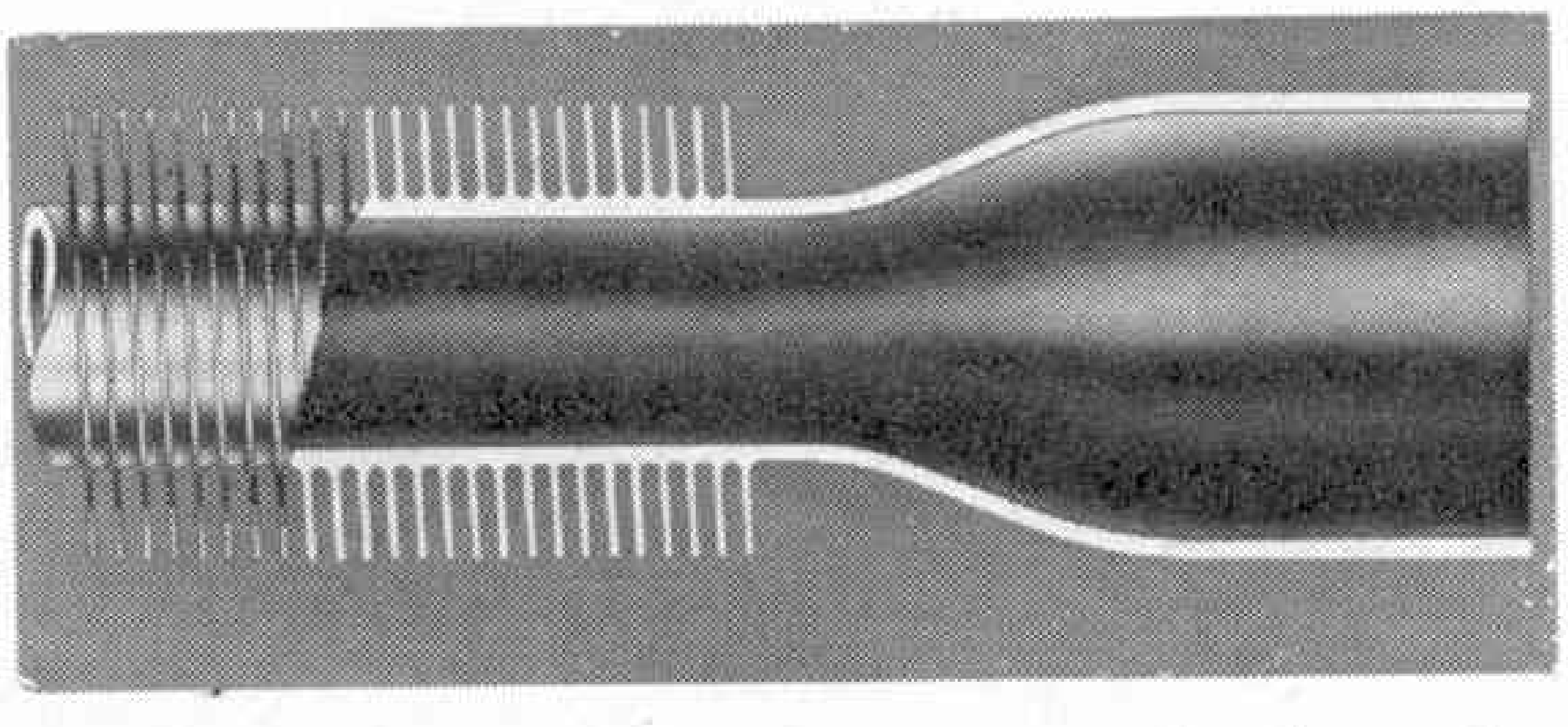
It is interesting to note that only one mechanism of heat transfer, convection, had been studied by that time, in 1701. Newton's experiments on cooling showed that the rate of convection heat transfer may be expressed as Q = Convection Coefficient (h) × Area (A) × Temperature Difference (ϕ). Much experimental work since then has shown that the coefficient h can have widely different values. From this relationship the units of h must be Heat/Area × Temperature Difference × Time, for example, Joules/metre^2 × deg. C × seconds. For natural convection, with no pump or fan moving the fluid, h in these units can be as low as 3. In forced convection from uranium to liquid metal in a nuclear reactor, h can be as high as 100,000. As a domestic fan heater uses forced convection and its coefficient h is much higher than for natural convection, a fan heater can be made much smaller than an ordinary convector, for the same heat output.

Fourier studied conduction in solid materials, and published his results in 1822. He found the rate of conduction heat transfer can be expressed as Q = Thermal Conductivity (k) × Area (A) × Temperature Gradient. The conductivity k depends on the material, it has units such as Joules/metre^2 × seconds × (deg. C/metre). For engineering materials, k is 386 for copper in these units; at the other extreme it is 0.04 for glass fibre, a widely used insulating material. Though this value for glass fibre seems low it is by no means a perfect insulator. 1 kW of heat will flow through a slab of area 10 metre^2 and 4 cm thick, if the temperature difference across it is 100 deg. C.

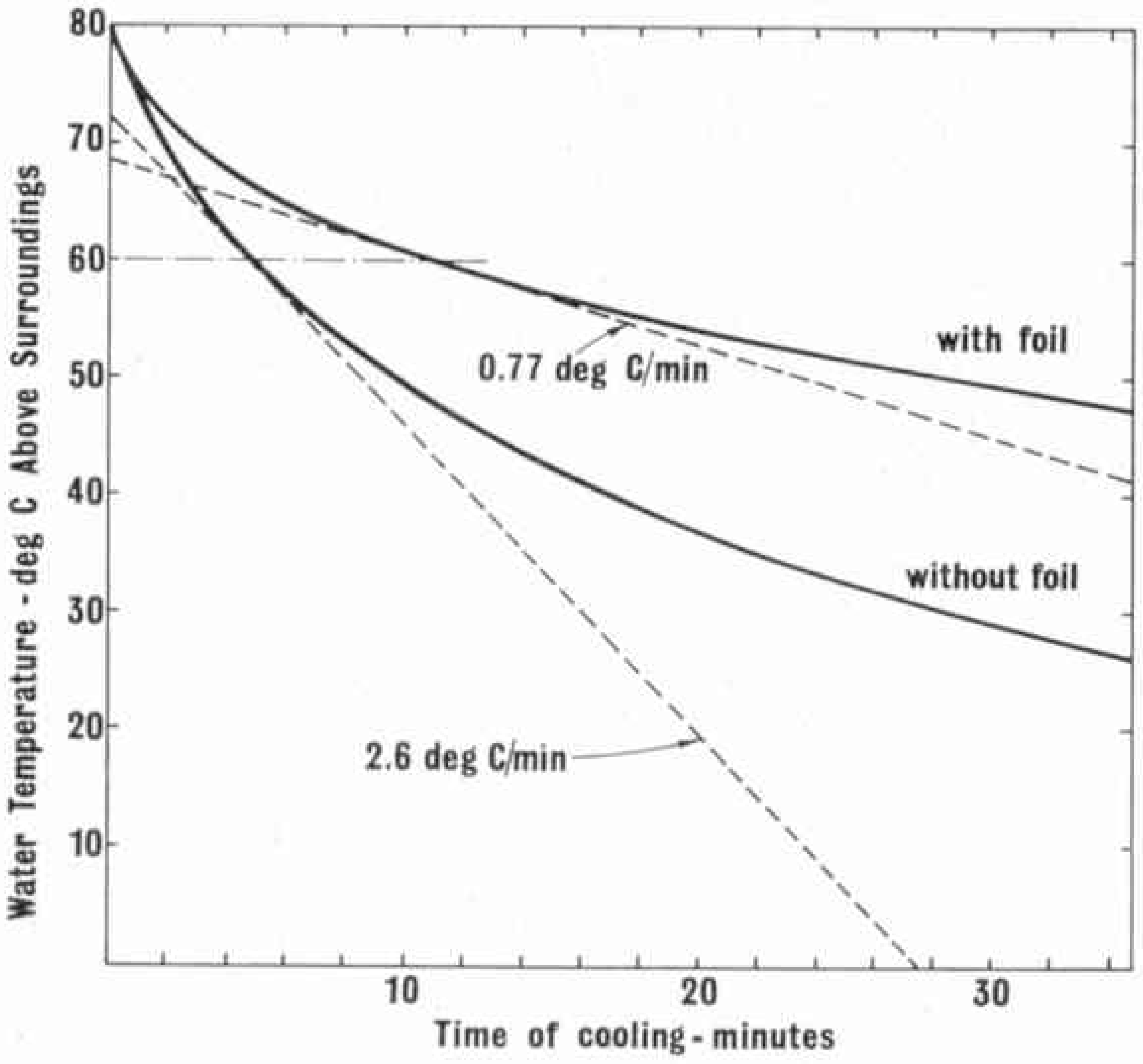
The work of Stefan and Boltzmann on radiation was again much later, between 1879 and 1884. The rate of radiation from a surface depends on the fourth power of the absolute temperature. This means radiation heat transfer is very important at high temperatures, in furnaces and combustion chambers. A surface at 1000°C, which is 1273° on the absolute Kelvin scale, radiates heat at sixteen times the rate of a surface at half the temperature, namely 637°K or 364°C. Radiation also depends on the surface. Thus black surfaces radiate and absorb much more than highly polished ones, which do not radiate very well, but are good reflectors. On a sunny day you feel hotter in a dark suit than in a light one.

As understanding of heat transfer has progressed, the engineer is increasingly able to calculate thermal systems more closely and to design accordingly. Promoting heat transfer is necessary in boiler plant for power generation, in chemical processing, in air conditioning plant, and in cooling of internal combustion engines, giant turbo-alternators, and electronic equipment. In all these fields great improvements have been made in recent years. Thus, synthetic fluids such as

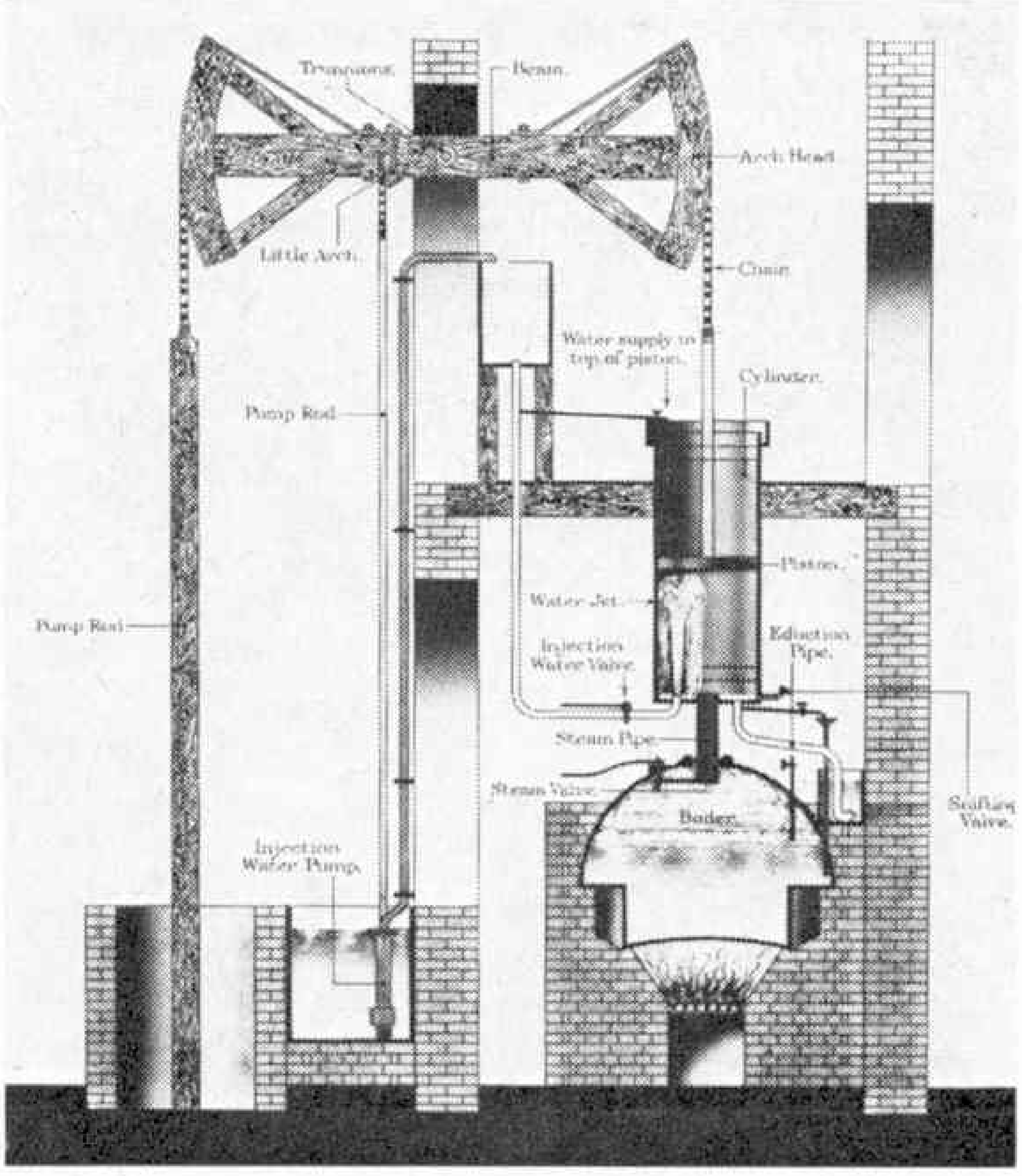




Above: Convection coefficients for gases are often lower than for liquids, so if the area exposed to the gas is increased, greater heat transfer results. This finned tube is for use with a gas outside and a liquid inside. Photo. courtesy of A.E.I. At left: This is the 150 b.h.p. gas turbine engine which powered the Rover B.R.M. at Le Mans in 1965. To the left can be seen part of the circular rotating heat exchanger matrix made of glass ceramic. Compressed air is heated by the exhaust, before entering the combustion chamber, to save fuel. Photo. courtesy of Leyland Gas Turbines Ltd.



The graph above shows the results of an experiment to measure rates of heat transfer from a beaker of hot water. Note the slower cooling rate when the beaker is wrapped in foil. At right: The Newcomen atmospheric pumping engine of 1712. This was the first practical use of the heat transfer process for power generation. Photo courtesy Science Museum, London.



chlorinated hydrocarbons, can be used to cool electronic equipment. The electronic components are immersed in the fluid, which boils, and condenses again on a surface that dissipates heat. High rates of cooling can thus be achieved.

Prevention of heat transfer is concerned with high and low temperature insulation. Heat loss must be prevented as much as possible from the exterior of boiler furnaces, steam pipes and heat exchangers. Space craft must be protected by a heat shield in re-entry. Low temperature insulation is necessary in refrigerators, liquid gas containers, and in buildings.

A simple experiment to measure and compare rates of heat transfer can be performed at home. A beaker of hot water is allowed to cool and the temperature and time are recorded. When the beaker is refilled and wrapped in cooking foil, a much slower rate of cooling will be observed. The foil will gently reduce the radiation loss, and partly reduce the convection loss. The temperature of the water above room temperature is plotted against time, and a tagent to the curve is the rate of temperature drop. A heat transfer coefficient which includes convection and radiation effects can be found from:

Mass of water (kg) × specific heat (J/kg deg. C) × rate of temeprature drop (deg. C/second) = Temperature of Water above surroundings (deg. C) × surface area (metre^2) × Heat Transfer Coefficient (J/metre^2 second deg. C).

This gives an average coefficient over the whole area of the beaker and water surface, or of the foil. With a specific heat of water of 4187 J/kg deg. C, two values obtained are 14.4 and 48.6 J/m^2 sec. deg. C, with and without the foil, at 60 deg. C above room temperature. These are only guiding values. You will obtain other values and at different temperatures.

Workbench—*continued from page 123*

and 30c. to complete his collection of Kenyan definitives, and so, from the page in front of him he took those values. They cost him 25c.—about two shillings. It was only later that he noticed that the 5c. ' looked kind of weird '!

The boy's mother then took it round to several New Jersey deolers but no-one seemed interested, except one, who took the matter further. The stamp was sent to the Royal Philatelic Society in London and, in spite of the stamp printers' reluctance to admit that the stamp could exist with this variety, it was certified as genuine without hesitation.

As a result, the stamp was bought by His late Highness the Ameer of Bahawalpur for what was, at that time, the highest price ever paid for a modern British Commonwealth stamp, and, in consequence, the lucky New Jersey boy was assured of an otherwise too-expensive college education.

The odds against finding one of the world's greatest rarities in an approved selection would defy the most able bookmaker, but nevertheless it happened and the stamp which was purchased for about two shillings was sold to an anonymous American for £4,300 on December 12th. Stanley Gibbons informed us that this is a world record price for any stamp of the current reign.

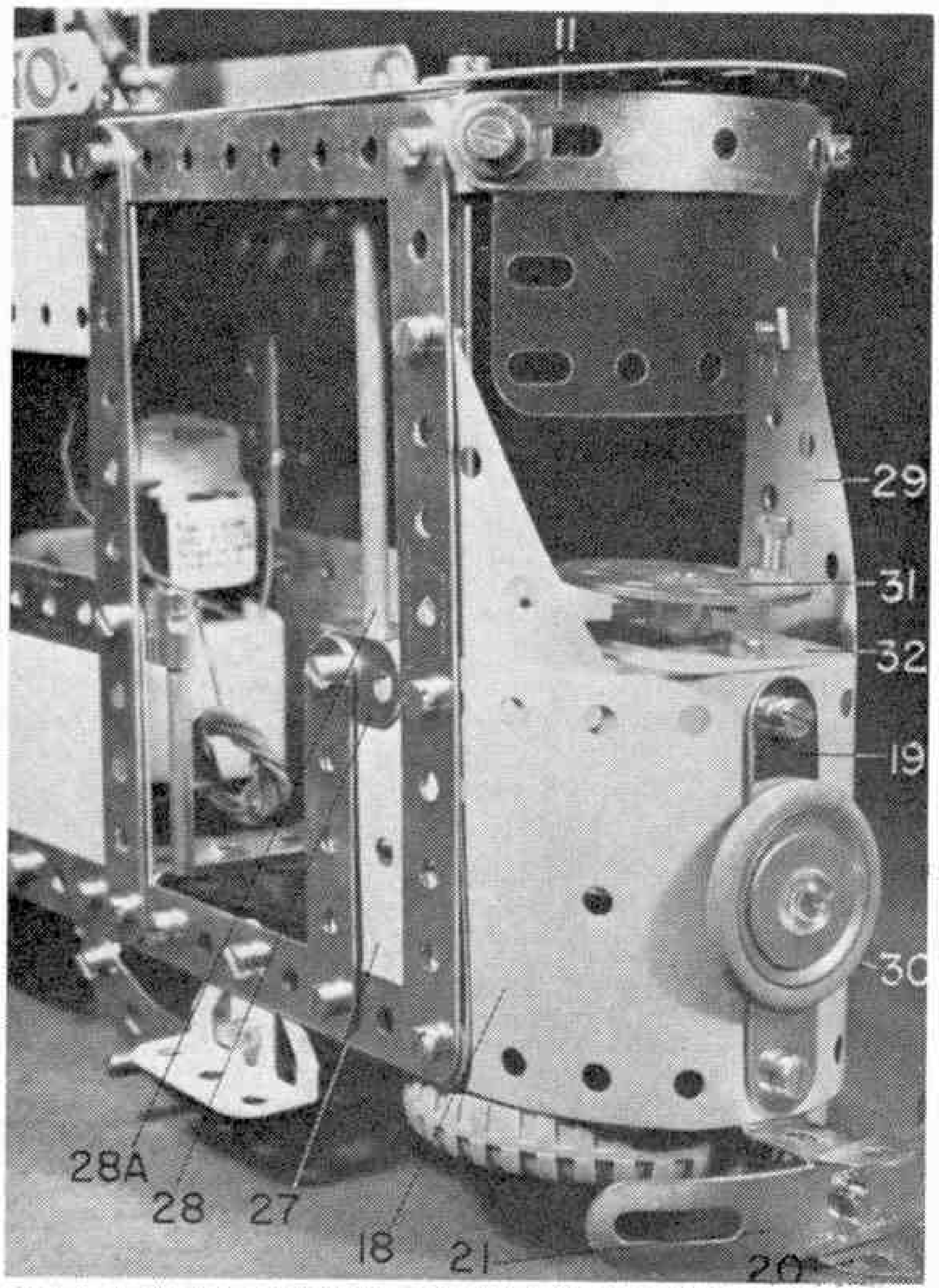
New Year Show—Stop Press

This year's Meccano model building competition held at the Daily Mail New Year Show on the Meccano stand—was once again a great success. No less than 1,341 contestants constructed or tried to construct the Standard Meccano Lorry from basic parts and 224 contestants won their six at a time heats. As ever the range of entrants was varied with almost young toddlers pitting their wits against 16 year olds. The winner, by virtue of constructing the fastest lorry of the show was 14-year-old Peter Blunden of 111A Murray Road, Ealing, London, W.5. Peter wins a No. 6 Meccano outfit for his efforts.

Power Drive Tram

A working model of a single-deck sea-side tram with authentic overhead pick-up built from the contents of the Power Drive Set.

by B. N. Love



One end of the model showing the imitation control wheel and entrance door. Note that the "lamp bulb" in the middle of the headlight is supplied by one of the plastic studs used to hold the parts contained in the Outfit in place.

THIS NEAT little working model of a sea-side tram is an excellent example of the realistic models that can be built with the Power Drive Set. It uses most of the parts in the outfit to full advantage and works in a very realistic manner picking up the current from an overhead wire through a proper trolley-pole mounted on the roof. It runs with great realism from a supply varying between 6 and 12 volts D.C.

Construction

As far as construction goes, the framework of the model is completely symmetrical, therefore both sides are similarly built, as also are both ends. Each side consists of two 12½ in. Strips 1 and 2 connected by four 5½ in. Strips 3, 4, 5 and 6, the upper Bolts securing Strips 4 and 5 also holding a 5½ × 1½ in. Flexible Plate 7 in place as well as fixing a 5½ × 2½ in. Flanged Plate 7a between the sides. The upper Bolts securing Strips 3 and 6 each fix an Obtuse Angle Bracket in place and a 2½ × ½ in. Double Angle Strip 8 between the sides, then Flanged Plate 7a is extended eight holes at either end by a 4½ × 2½ in. Flat Plate 9, itself extended by a Semi-circular Plate 10, also bolted to Double Angle Strip 8. A Formed Slotted Strip 11 is bolted between the Obtuse Angle Brackets at each side, at the same time "sandwiching" a 2½ × 1½ in. Transparent Plastic Plate between the Formed Strip and the Obtuse Brackets to serve as the driver's windshield.

PARTS REQUIRED

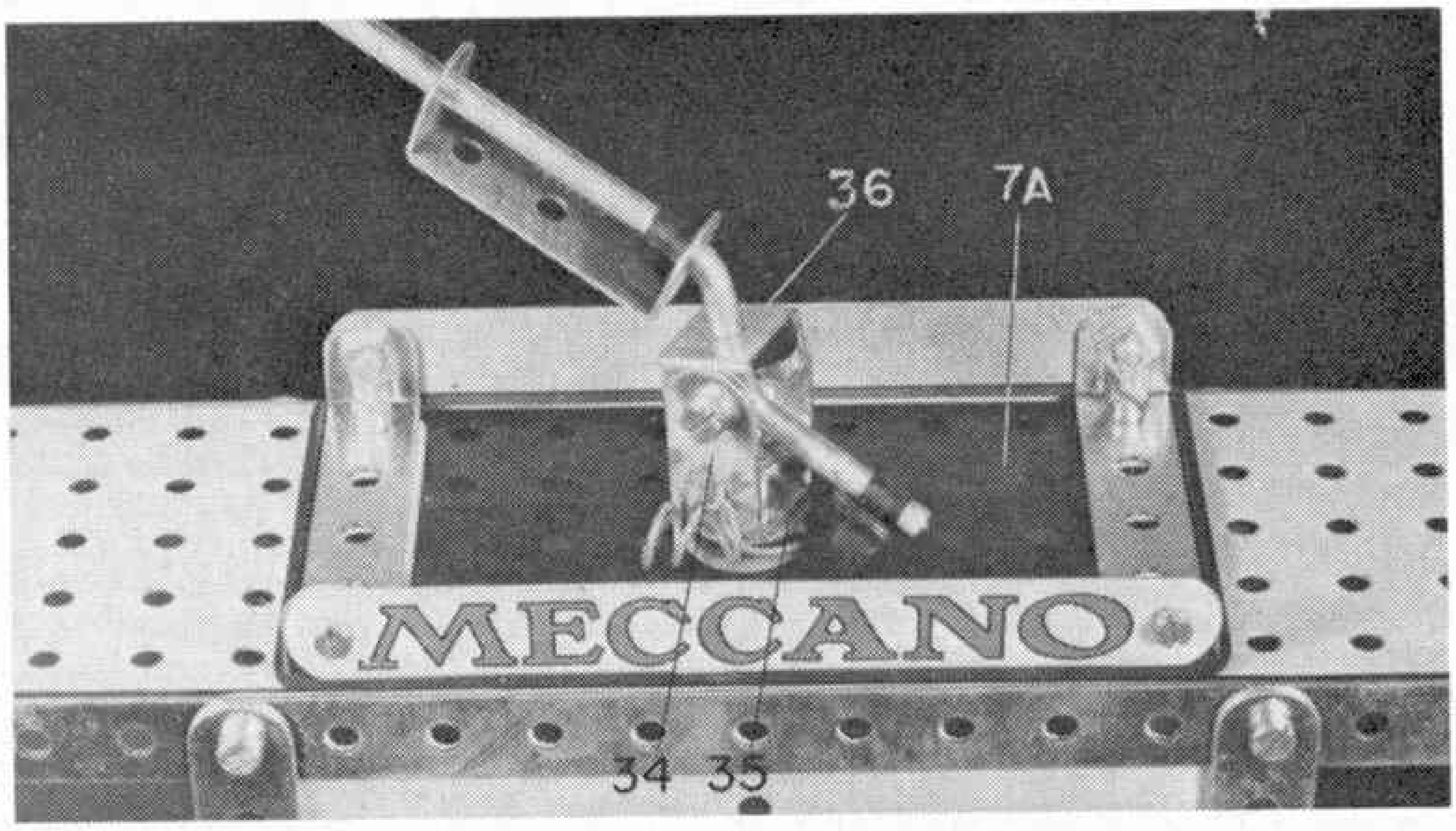
4—1
8—2
2—3
9—5
6—10
2—11
1—11a
10—12
2—12b
4—12c
1—15b
4—16
2—17
2—18a
1—18b
1—19s
1—20a
4—22
2—22a
1—23
2—23a
2—24
8—35
100—37a
90—37b
18—38
2—38d
10—40
1—48
6—48a
1—51
1—52
2—53a
2—54
4—90a
6—111c
2—125
2—126
2—126a
2—155
1—176
1—186
1—186a
1—186b
2—187
2—188
2—189
4—190
2—191
2—192
2—193
2—193a
1—194
2—194a
1—212
2—212a
1—213
2—214
4—215
4—221

Bolted between the lower ends of Strips 4 and 5 at each side are two further 2½ × ½ in. Double Angle Strips 12, spaced from the sides by a Washer on each securing Bolt. This extra spacing later allows two Flanged Sector Plates 13, forming the driving platforms, to be fixed in position between Strips 2, but, first, a Trunnion 14 is bolted each side of the Tram at the entrance to serve as the passenger step. Secured to this Trunnion and to a Fishplate fixed to Strip 2 is a 2½ in. Stepped Curved Strip 15, a similar Curved Strip 16 being bolted to a 1 × ½ in. Angle Bracket and another Fishplate fixed to Strip 2. The Bolt securing the latter Curved Strip to the Fishplate also holds an Angle Bracket 17 in place to balance the 1 × ½ in. Angle Bracket. The Curved Strips, of course, will provide the bearings for the bogie wheel axles.

Flanged Sector Plates 13 can now be positioned, an operation achieved by bolting the wider ends of the Sector Plates to the side frames of the Tram and by attaching the front of the Plate, by means of an Angle Bracket, to a 4½ × 2½ in. compound flexible plate 18, forming the front of the driver's cab and obtained from two 2½ × 2½ in. Flexible Plates, the join overlayed by a 2½ in. Strip 19. The front securing Bolt also holds in place a ½ in. Reversed Angle Bracket, to which a Double Bracket 20 and a Formed Slotted Strip 21 are bolted, the latter acting as the bumper, and the former serving as a towing shackle.

The sides of the model are now completed with a 5½ × 2½ in. Flexible Plate 22 and a 4½ × 2½ in. Flexible Plate 23, overlapped two holes. Plate 23 is edged along the top by a 3½ in. Strip 24 while Plate 22 is

In this close-up view, the construction of the trolley pole swivel is clearly shown.

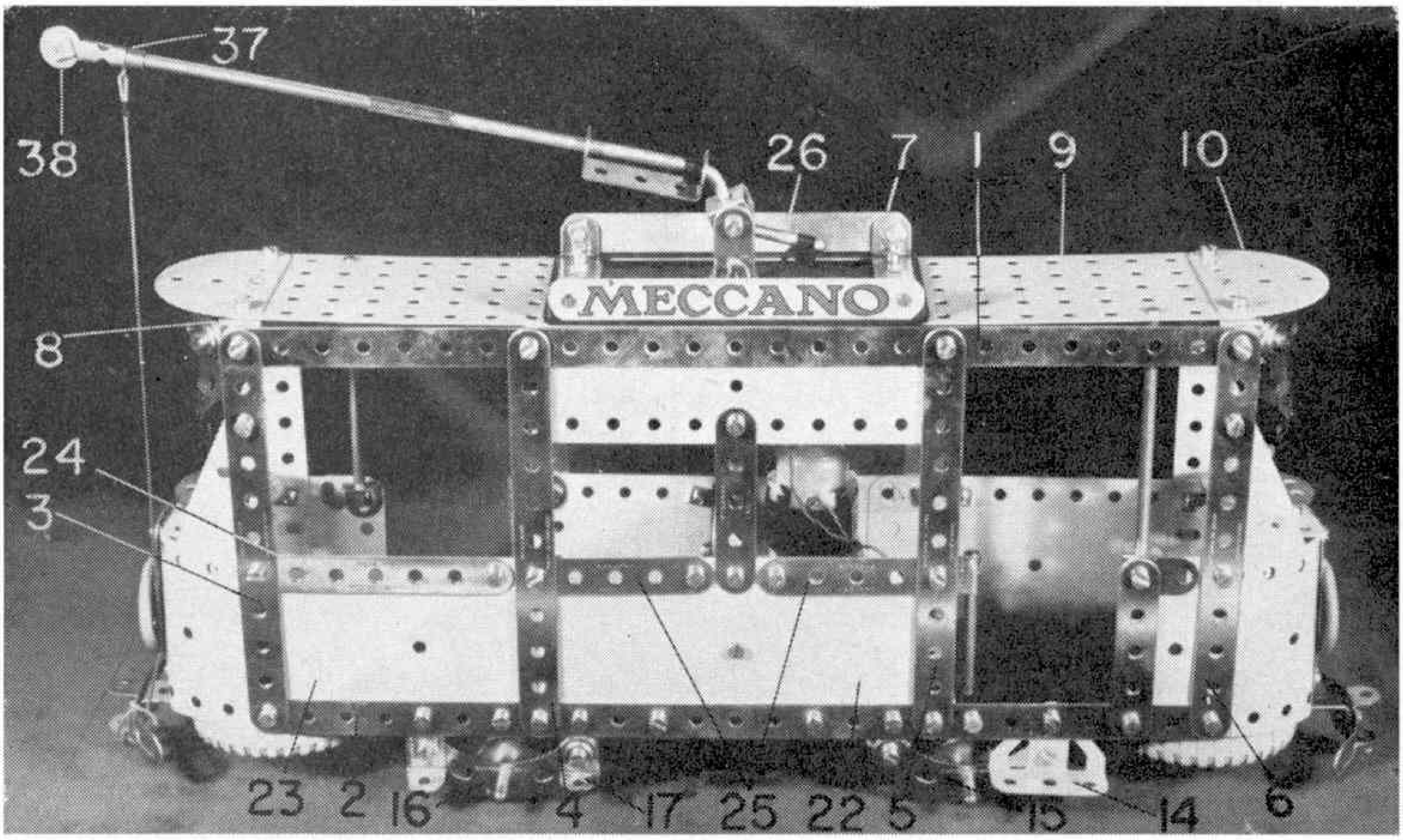


This little Tram model, built with the contents of the Meccano Power Drive Set, is authentic in operation, picking up the current from an overhead wire through a working roof-mounted trolley pole.

edged by two 2½ in. Strips 25, a half-inch space being left between them to allow a third 2½ in. Strip 26 to be bolted between Plate 22 and Plate 7, as shown. Compound flexible plate 18 is extended by a 2½ × 1½ in. Flexible Plate 27, edged by a 2½ in. Strip and a Fishplate 28, the securing Bolt also holding an Angle Bracket in place. A 3½ in. Rod is journalled in this Angle Bracket and roof Flat Plate 9 to act as a handrail. Another handrail is supplied by another Rod 28a held in a right-angled Rod and Strip Connector bolted to Strip 5.

Windows for the central motor compartment are supplied by 2½ × 2½ in. Transparent Plastic Plates. There are only two of these available in the Power Drive Set, but they may of course be fitted in the alternative window positions. The driver's cabs are completed with 2½ × 1½ in. Triangular Flexible Plates 29, then a headlamp is added to each of the two cab fronts. Each of these headlamps is obtained from a 1 in. Pulley with Rubber Ring 30, overlayed in the centre by a ¾ in. Washer and held in place by one of the special plastic studs used to retain parts in the tray of the Power Drive Set. The stud is secured inside the Tram by a standard Nut run onto the stud by the Spanner contained in the Outfit. This simulates an electric lamp bulb in the middle of the headlamp with great effect, but, in the absence of the plastic studs, a ⅜ in. Bolt may be employed.

Inside each cab, the imitation driving control handle is made from an 8-hole Bush Wheel 31, fitted with a ⅜ in. Bolt fixed in the centre hole of a Flat Trunnion 32 secured to the cab front by an Angle Bracket. A 2½ in. Road Wheel 33 is mounted below the driver's cab at either end of the model to add depth to the control gear appearance. These Road Wheels are secured on short Rods passed through Flanged Sector Plates 3 and held in place in one case by a Spring Clip and Washer and, in the other case, by a 2 in. Pulley.



Motor and electrical pick-ups

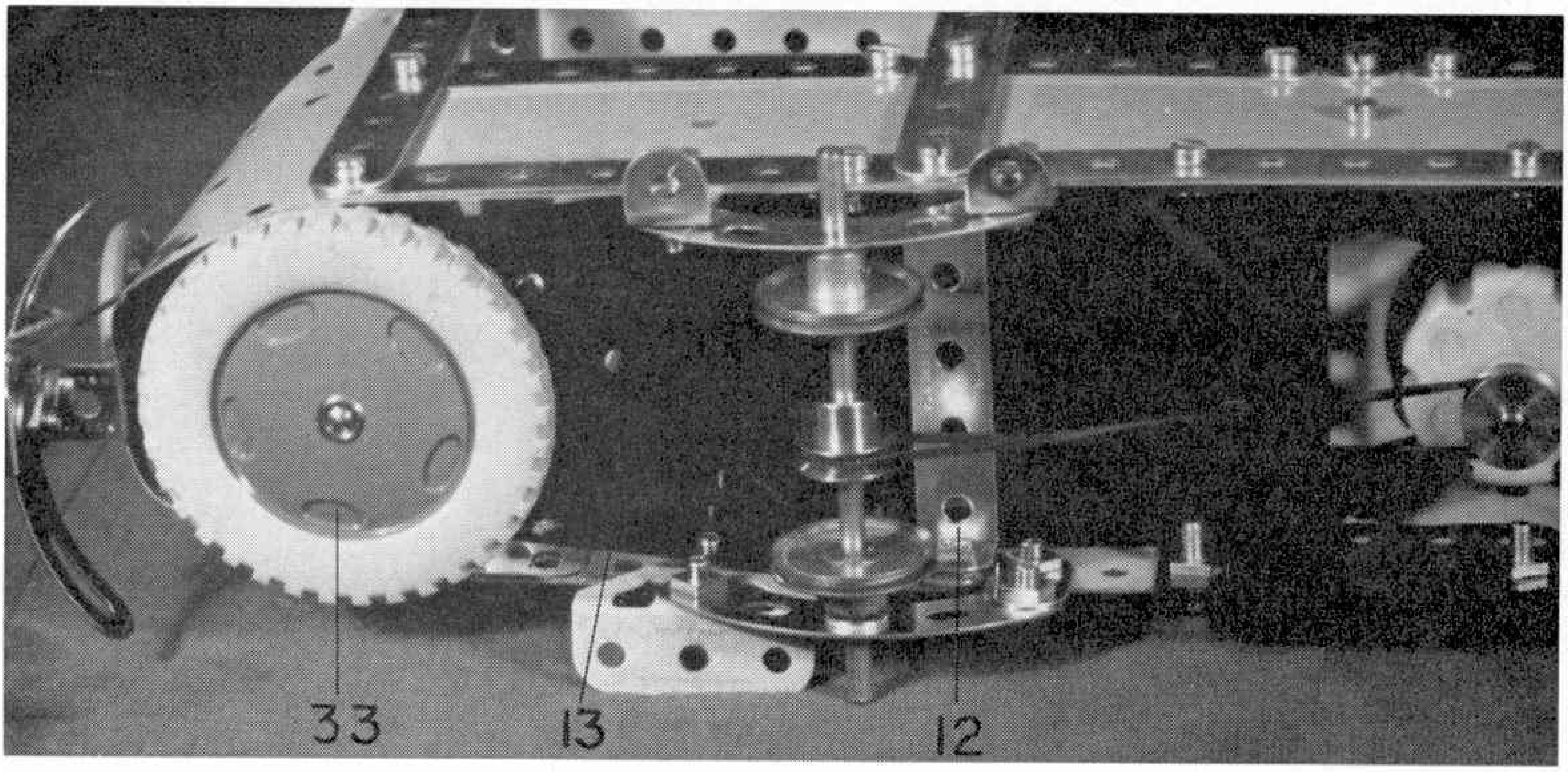
Coming, now, to the power plant, a Power Drive Unit is fixed to a 2½ × 1½ in. Flanged Plate bolted between the centre holes of Flexible Plates 22 and spaced from the sides by a Washer on the shank of each securing Bolt to maintain a uniform width between the sides of the Tram. The motor leads are passed up through the roof ready to be connected to the trolley pole. This is built up from a 1 × ½ in. Double Bracket 34 pivotally attached to Flanged Plate 7a, but spaced from the Plate by a ½ in. Pulley without boss 35. As the Pulley in the Power Drive Set is produced from red plastic, it acts as an insulator between the Double Bracket and the Flanged Plate but note that the securing Bolt must also be insulated from the Plate. The best way of doing this is to use a non-metallic bolt such as the nylon type than can be obtained from some electrical suppliers, but, failing this, the 10 in. Driving Band included in the Power Drive Set may be threaded through Pulley 35 and then secured to the Flanged Plate carrying the Power Drive Unit by threading it through a suitable hole and securing the loop with a Spring Clip slipped through it. On the other hand, a standard Meccano Bolt could be used provided it was adequately insulated from the metal parts by a suitable insulator. If the nylon bolt method is chosen, however, its thread form needs to be 5/32 in. Whitworth to be used with Meccano Nuts.

Lock-nutted to the lugs of Double Bracket 34 is a ½ × ½ in. Double Bracket 36 in which a 3½ in. Crank Handle is held by a Spring Clip wedged against the locking Nuts. This combination makes a very satisfactory locking device as it not only wedges the trolley pole in the correct position, but it also prevents the trolley pole from shifting and the locking Nuts from shaking loose. The pole is " sprung " by a 2½ in. Driving Band which runs round the groove of Pulley 35 and is then twisted to form a loop that is passed round another Spring Clip mounted on the end of the Crank Handle. Adjusting the size or twists of this loop will vary the tension on the trolley pole.

The Crank Handle itself is extended by a 3½ in. Rod attached by a Rod Connector and on the end of the Rod is mounted a pick-up shoe consisting of a Cord Anchoring Spring 37 and a Rod and Strip Connector 38. A Nut, sandwiched between a Washer and the head of a ⅜ in. Bolt, is fixed in the Rod and Strip Connector, the Nut being so arranged that it presents a flat edge to the overhead pick-up wire. A length of Cord acting as the trolley rope is attached to the eye of Cord Anchoring Spring 37, the other end being attached to some part of the back of the Tram such as the bumper. As it must be possible to reverse the position of the trolley pole according to the direction in which the Tram is to travel, the trolley rope should be so fixed to the model that it can be easily disconnected. One of the motor leads is now connected to Double Bracket 34, the other lead being " earthed " by bolting it to some metal part of the model's framework.

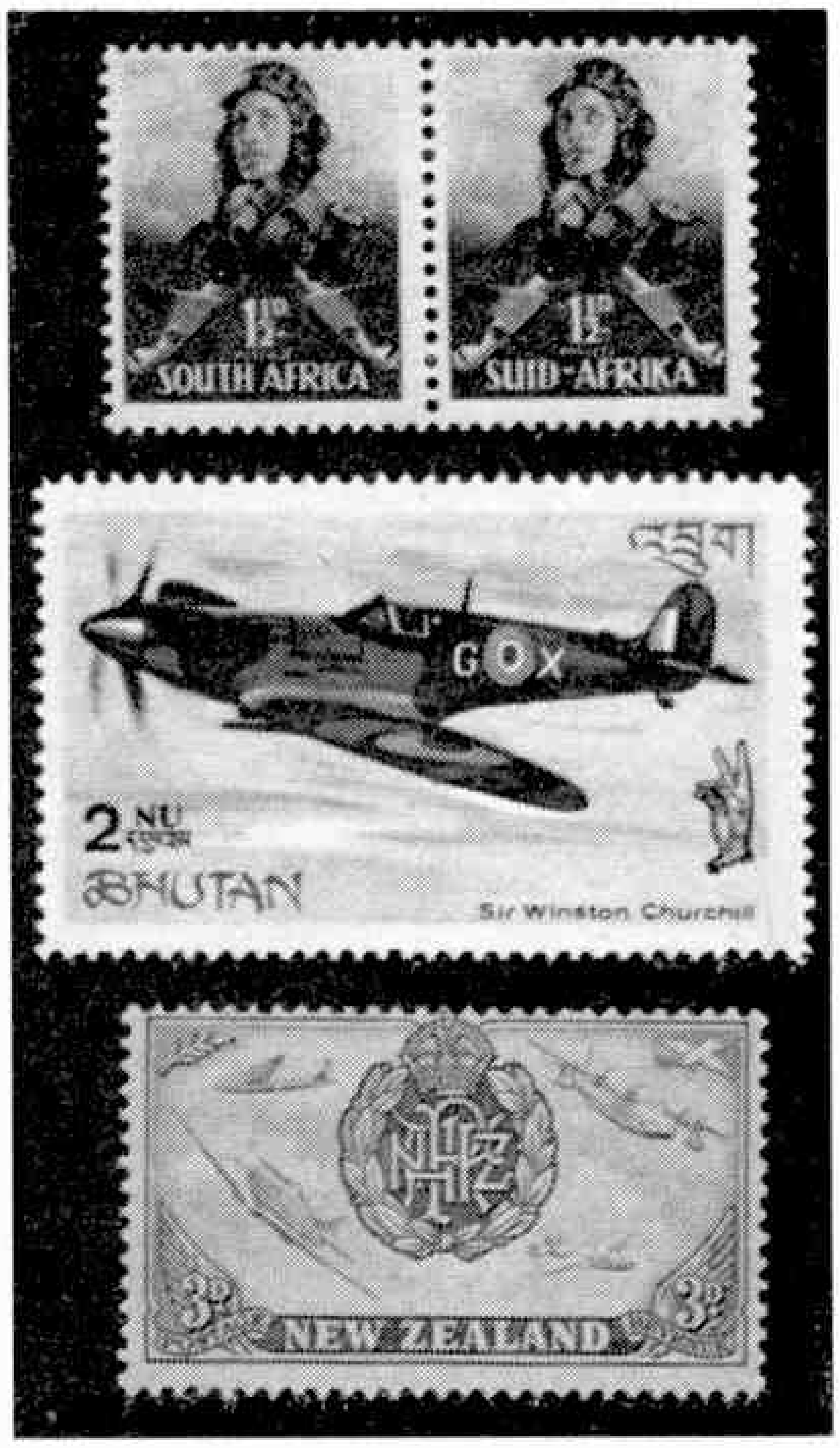
The wheels are supplied by 1 in. Fixed Pulleys 39 mounted in pairs on two 3½ in. Rods journalled in Stepped Curved Strips 15. Also mounted on one of the Rods is a ½ in. fixed Pulley 40 which is connected by a 6 in. Driving Band to a ½ in. Pulley fixed on the output shaft of the Power Drive Unit. For short runs on two or three feet of track, the Power Drive Unit is set on the 32 : 1 ratio but, if a longer length of track is available, the 16 : 1 ratio may be used to take advantage of a higher speed. Tram rails are made from Angle Girders which are, of course, additional to the Outfit. They are best joined together by fishplates made from brass Elektrikit 2 in. Perforated Flexible Strips to ensure a smooth continuity of rail. The stanchions which support the overhead wire can be made to suit the constructor's personal taste, but the bare copper wire contained in the Elektrikit forms an ideal overhead conductor wire and, if the stanchions are secured to a board or a wooden floor, no special insulation is required. The original model was controlled by a 12 volt. DC model railway power control unit, one lead being connected to the rails and the other to a nearby stanchion.

A close-up view of the driven axle showing the position of the Power Drive Unit.



SPITFIRES on STAMPS

by James A. Mackay



PROBABLY NO other fighter aircraft has left such a mark on philately as the famous Spitfire which, for so many, has symbolised the fight of the Few in the Battle of Britain. Yet, oddly enough, it made its philatelic debut not on a British stamp but on a series released in one of the lesser known French colonies. After the fall of France in 1940 and the establishment of the collaborationist Vichy government, a number of the overseas territories decided to support the Free French movement led by General de Gaulle. One of the first countries to throw in their lot with De Gaulle was Cameroun in equatorial Africa.

Not only did Cameron overprint its stamps to mark its adherence to De Gaulle but, in November 1940 released four stamps with a special 5 francs surcharge and the word SPITFIRE, the object being to raise funds to equip the Free French air force with a squadron of Spitfire fighters. The contemporary 25, 45, 60 and 70 centimes stamps showing the Banyo waterfall were thus treated. I do not know whether the sales of these fund raising stamps came up to expectations but today they are pretty scarce and are currently catalogued by Stanley Gibbons at £40 the set. The following February two stamps, originally released in 1939 to honour the New York World's Fair, were re-issued with a 10 francs surcharge; the words SPITFIRE and "General de GAULLE" were also overprinted. Though more expensive to buy at the time they were current, these two stamps are somewhat easier to come by nowadays.

The first actual picture of Spitfires to appear on a stamp was released in January 1942. South Africa introduced a wartime series depicting the activities of the armed forces. The 1½d stamp portrayed a fighter pilot and if you examine the stamp closely you will see two tiny Spitfires in the lower corners. These stamps were printed in bilingual pairs, the stamps being alternately inscribed in English or Afrikaans, so they are best collected in this way. These stamps had a relatively short life, however, being replaced seven months later by the tiny bantam design which portrayed the pilot but omitted the aircraft from the design.

Another four years elapsed before the Spitfire was shown on a stamp again. In April 1946 New Zealand issued a long set of Peace commemoratives, the subjects of the middle denominations being the contrast between peace and war. The 3d. stamp featured the badge of the Royal New Zealand Air Force flanked by war planes and commercial aircraft. The lower left hand corner depicts a Spitfire in a climbing turn.

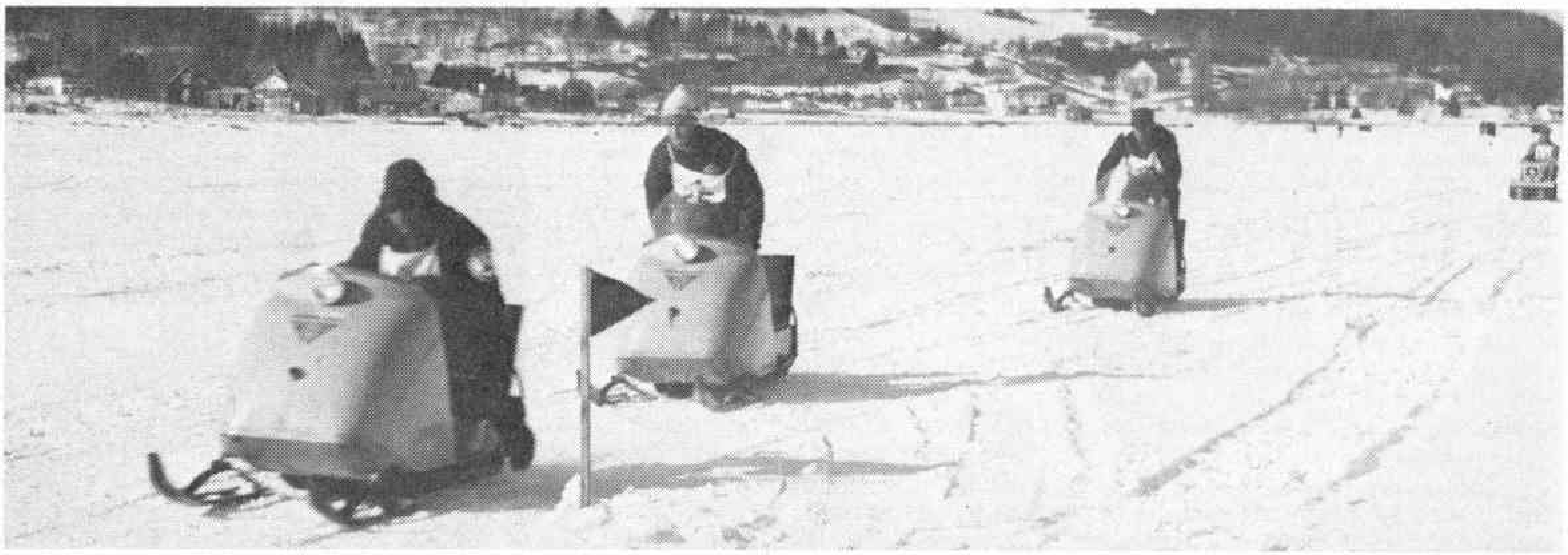
In 1965 the United Kingdom issued a set of eight stamps to mark the 25th anniversary of the Battle of Britain. Six of the stamps were fourpenny ones printed side by side in the same sheet. On four of these the Spitfire was featured prominently. A frontal view of a flight of Spitfires appeared on one stamp; another showed a Spitfire wingtip superimposed symbolically on that of a Messerschmitt fighter. The other two showed a Spitfire attacking a Stuka dive-bomber and a pair of Spitfires attacking a Heinkel bomber. The stamps were released on 15th September, the anniversary of the greatest single air encounter of the Battle. In connection with the celebrations a special postmark featuring a Spitfire was used at Biggin Hill aerodrome in Kent, the forward headquarters of Fighter Command during the Battle of Britain.

Between 19th June 1940, when the first major air raid began and the beginning of 1941 Britain suffered bombing on a scale never endured by any country before. During that period 23,081 people were killed and more than 32,000 were wounded. It was hardly a decisive victory and, in fact, defeat was only narrowly averted thanks very largely to Fighter Command. It was of them that Sir Winston Churchill said, "Never in the field of human conflict was so much owed by so many to so few."

Because Churchill is always specially remembered in connection with the Battle of Britain it is hardly surprising that the Spitfire has been featured on some of the stamps which have been issued during the past four years since his death. The Arab territory of Khor Fakkan (a dependency of Sharjah) issued a set of four stamps in March 1966 and showed Spitfires and a destroyer, with the White Cliffs of Dover in the background, on the 5 rupee stamp. When Sharjah adopted the Arabic currency of dirhems and riyals, this stamp was re-issued with a surcharge in riyals.

In June 1967 the Himalayan kingdom of Bhutan released three stamps honouring Churchill and featuring famous aircraft of the Second World War. Two of the denominations showed a Lancaster bomber and a Hurricane fighter respectively while the third featured the Spitfire.

In December 1968 the Arab sheikhdom of Umm al Qiwain issued a series of stamps dedicated to famous aircraft in the history of manned flight. The 1.25 riyals stamp depicted a Spitfire—the only fighting aircraft of the Second World War to be thus honoured.



Snow Vehicles

by Harry McDougall

AS A symbol of the Canadian north, the sled drawn by husky dogs is fading into obscurity. The cry of " Mush! " is giving way to the road of petrol engines. New types of snow vehicles are proliferating like the first flivvers fifty years ago.

Most vehicles designed to traverse snow are direct descendants of machines conceived originally by a man who became known, during his lifetime, as the Henry Ford of the snowfields—Armand Bombardier of Valcourt, Quebec.

Bombardier's vision, and that of his company which has now grown far beyond its original size, was of a vehicle which would be able to negotiate the deepest snow but would be as easy to handle as an automobile. It took him twelve years to develop his first really successful machine and he called it the Snowmobile—a name which he failed to register as a company trademark and which eventually became the generic term for this type of vehicle.

The Snowmobile has changed little in basic configuration since the first model emerged from the Bombardier workshops. Often described as a " mobile cabin " it is angular, purely functional and devoid of frills. Exported to many countries it has become a symbol of Canadian enterprise.

The key to the success of the Snowmobile was the design of the tracks and suspension. Developed over a period of many years by a patient process of trial and error, they proved so efficient that a complete family of vehicles has been built around them. However, although these vehicles are immensely useful to exploration teams, prospectors, hydro maintenance crews and others who must travel over difficult terrain, they are of relatively little interest to the general public.

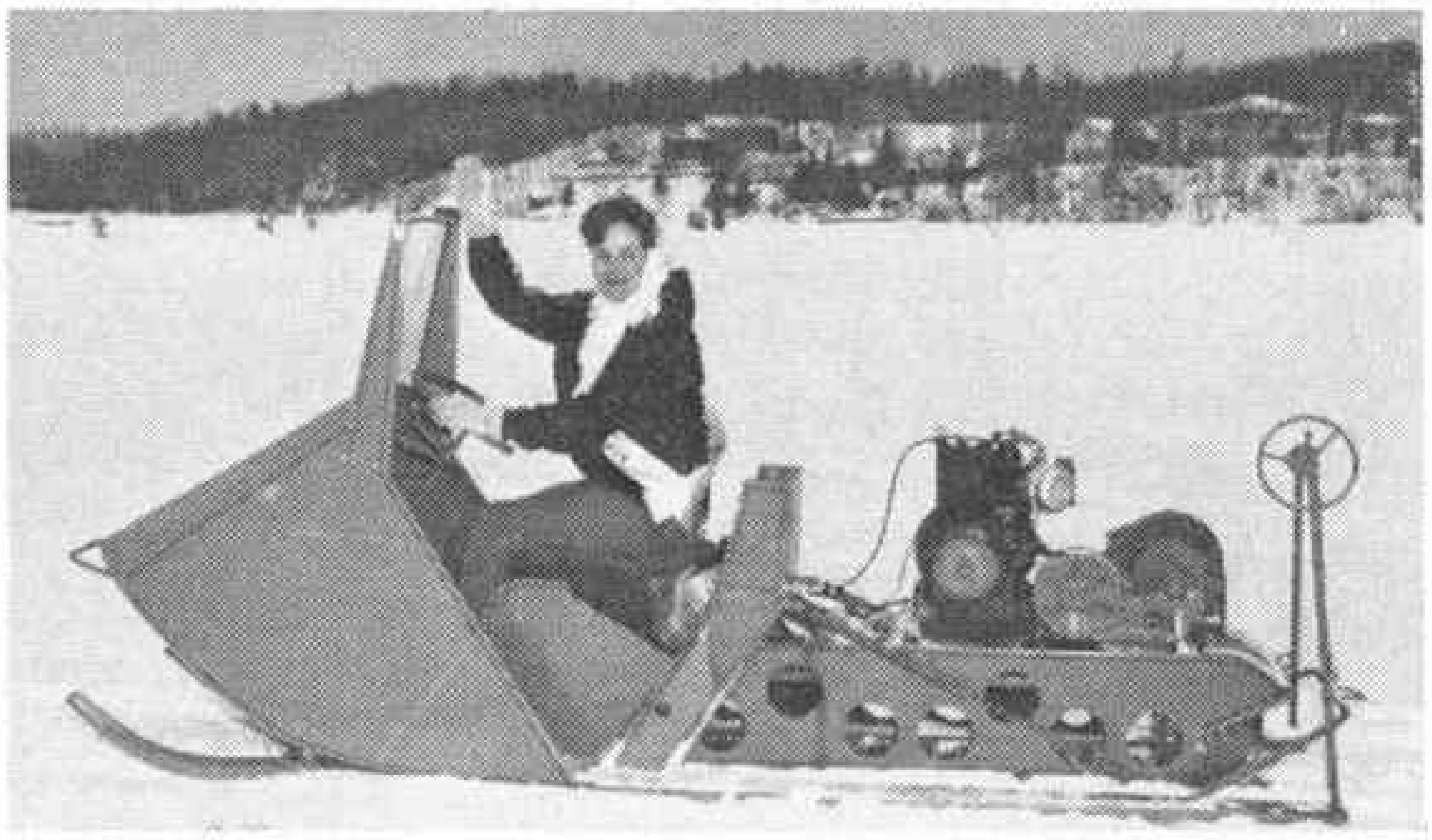
The spectacular breakthrough, which had made Bombardier a household word not only in the Canadian north but in many other countries where heavy snow falls, was the development of a tiny vehicle which Bombardier calls the Skidoo. It is essentially a motorized toboggan. An aircooled petrol engine drives a single or double flexible track to provide propulsion and the vehicle is steered by a motorcycle type handlebar connected to skis.

In 1959, Bombardier built 300 Skidoos. The following year 1000 were produced and annual production has since risen to more than ten times that number.

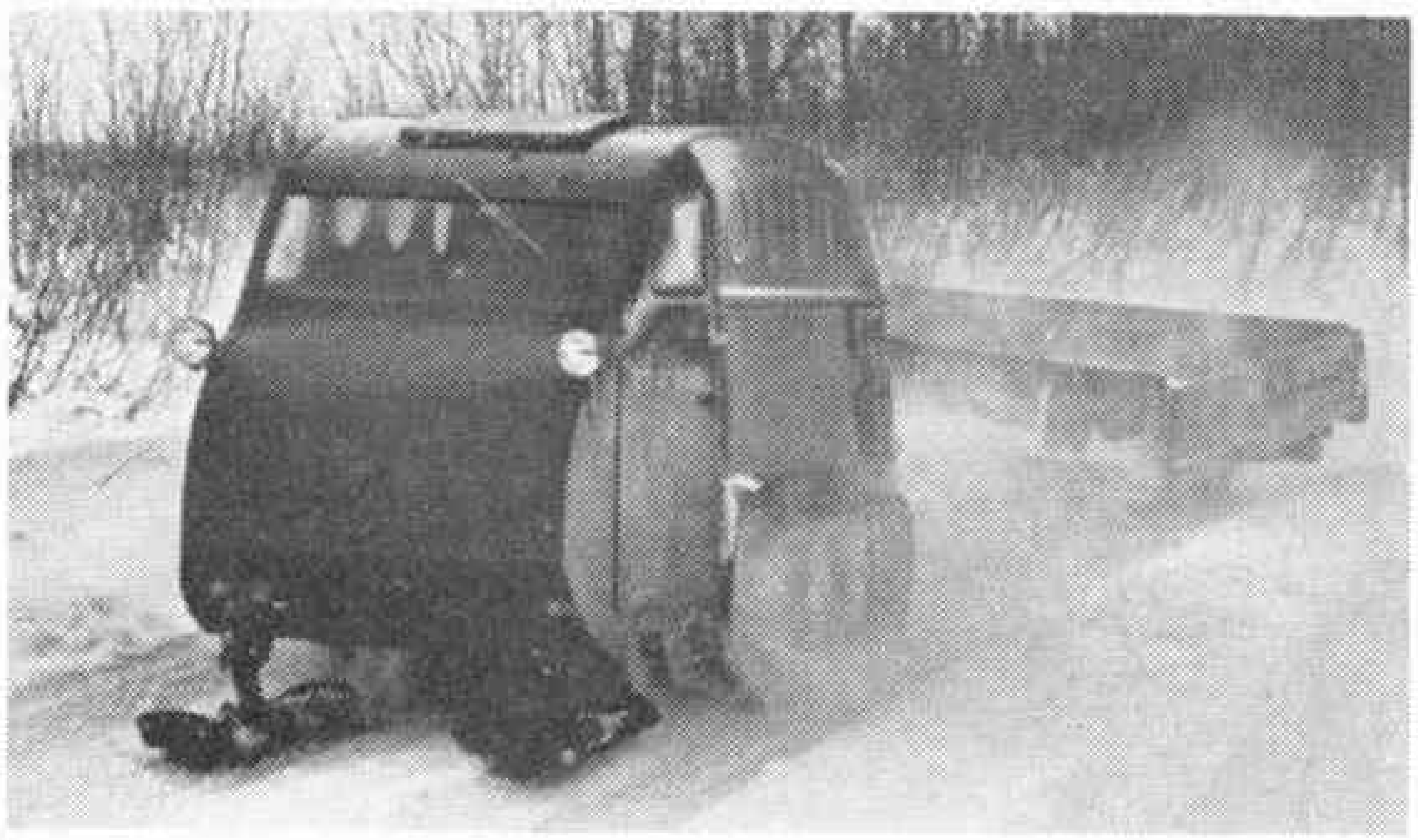
Although the Skidoo was conceived initially as a purely utility vehicle it was quite obvious from the outset that it had great potential for winter sports. Skidoos can be used for racing and ski-joring and they provide a means of reaching hunting and fishing areas otherwise inaccessible except on snowshoes.

There is some risk of a rider being tempted into venturing into areas from which, if he ran out of petrol, he might be unable to walk back. But winter sports enthusiasts are a gregarious group who recognize that lone snow travelling, like lone swimming, is always hazardous. Meetings of Skidoo enthusiasts are common. Indeed, there is every sign of snow vehicles having

Compare this early Autoboggan, with its exposed power unit and complete lack of streamlining, with the modern version, designed for the sportsman, which makes use of a moulded fibreglass cowling. Design has been improved a lot.



The Bombardier Snowmobile—the vehicle that started it all. Snowmobiles of this type are too big to be used by sportsmen but are in wide use by forest industries, mining companies and others operating in the wild and snowy Canadian northlands.



At left: Ski-doo racing—a popular pastime that was pioneered in Canada but is now popular in many other countries that experience heavy snowfalls. At right: Snow Cruiser—one of the latest of the new vehicles. It is ruggedly constructed and is designed to appeal to users who want something more than a purely utility vehicle. Note the sleek lines and headlamp.

founded a cult, much like that associated with sports cars. No self-respecting Canadian winter carnival would nowadays consider itself complete unless it featured Skidoo races.

Riding a Skidoo over the snow-covered surface of a frozen lake can be quite comfortable, but racing one over an obstacle course is more like handling a bucking broncho. Rugged construction allows them to withstand leaps several feet into the air and the customary stance in competitions is more akin to that of a skier than a motorcyclist!

The success of the Skidoo not only spawned a host of imitations but also stimulated the development of other vehicles intended to serve the same purposes but differing in configuration.

One of these is the Hus-ski, manufactured by Hus-ski Ltd. of Pointe Claire, Quebec. Unlike any of its competitors it is a dual unit in which a tractor is used to haul a sled carrying the riders. This arrangement offers several advantages. It lowers the centre of gravity, minimizing the risk of overturning, and it eliminates the risk of loose clothing becoming entangled in the tracks. It can carry three adults at speeds up to 28 mph.

Snow vehicles are permitted on North American roads provided they are fitted with lights and customary safety devices, but in general they are used far more as off-highway vehicles. They are small enough to be hauled around very easily on car trailers.

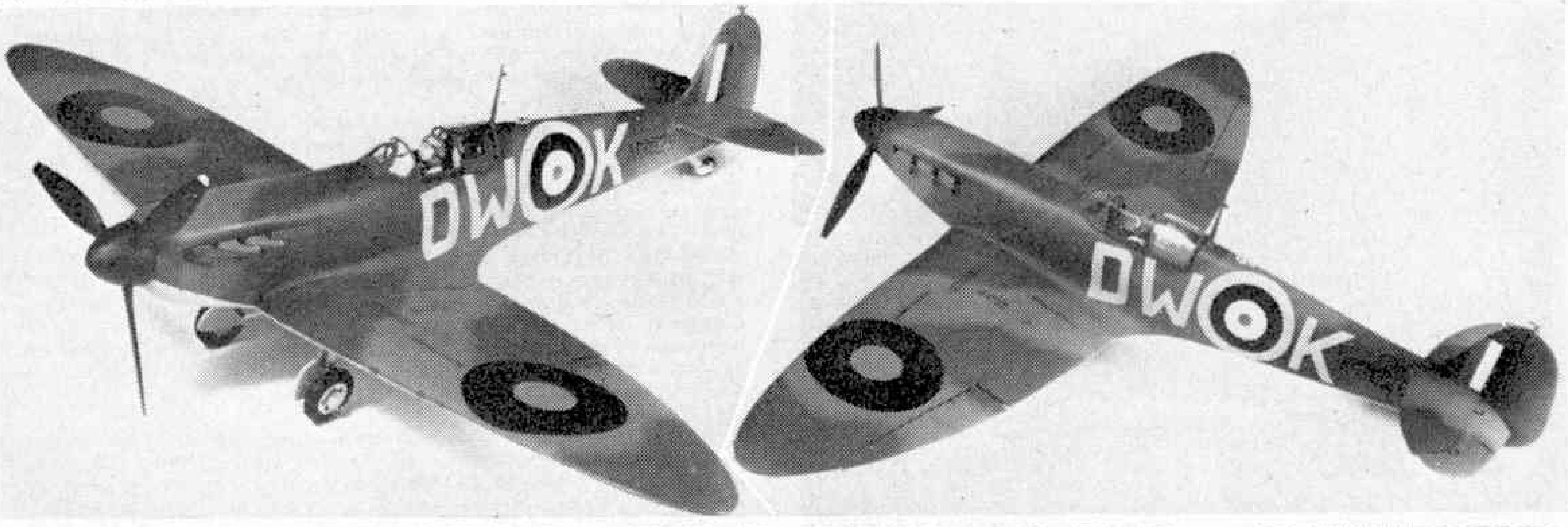
Sales of snow vehicles were originally confined to people who were interested only in their value as transportation. Since utility was the keynote of the design, appearance was secondary. Now, however, there has been a radical change in the approach of the vehicle designers. Advertisements still give technical data—type of engine, transmission, etc., but the information is in smaller type than formerly to leave extra space for large pictures printed in several colours. The vast majority of sales are now made to people who are interested only in riding the vehicles as a hobby. To help attract their interest, stylists are moving into the field and the latest models have all the seductive compound curves of the latest car designs.

Typifying this trend is the Snow Cruiser, built by Outboard Marine of Peterborough, Ontario. The Snow Cruiser has a blue, moulded fibreglass cowl, with a built-in headlight and a substantial windshield to protect the riders. Although it can be used as a utility vehicle it is obviously aimed at the sportsman and in this respect has become a trend-setter. The vehicle offers a ride which can be as exhilarating as skiing but is considerably less strenuous.

Many Canadian built vehicles are exported, but U.S. manufacturers have now entered the field and there seems little reason to doubt that the number of types of snow vehicles will continue to grow. A few golf courses which are open to skiers in winter have banned snow vehicles because of the risk of their tracks damaging fairways but, in general, motorized vehicles can be used wherever conventional winter sports are permitted.

The only serious design problem remaining to be solved is that of noise, which has long been the bane of outboard motor boats but is even more obtrusive with snow vehicles because the rider is closer to the power unit. Better silencer design may help solve this problem eventually.

★ ★



BUILD THEM BIGGER AND BETTER

Doug McHard describes and photographs his methods used to construct and finish the Revell Spitfire plastic kit illustrated above. Turn over for two pages of technique and plastic modelling hints and tips.

SIZE AND quality are not necessarily related, but in the case of the Revell Kit for the Spitfire I, full advantage has been taken of the possibilities offered by the choice of a big 1/36th scale, to incorporate detail, both internal and external, not possible in the more usual 1/72 scale. Building is not at all difficult, but the full potential of this fine kit will not be realised unless you tackle the painting and assembly patiently, and resist the temptation to put everything together immediately. There's a lot of internal detail which must be built up and painted before the major components can be assembled and the finished job will amply repay your patience. These photos were taken during the construction of our sample kit and there are a few tips which you may find useful even if you don't build this particular model. Our method of cementing the fuselage halves together, for instance photo 5 can be adapted for most kits and is a useful technique for all 'long' joints. Touch the adhesive on a part of the join that will not be seen—just in case you accidentally run any onto the outer surfaces. But even if you do get some outside, you can almost entirely eliminate surface damage by blowing *hard* on the surplus liquid immediately it starts to run.

STEP-BY-STEP BUILDING INSTRUCTIONS

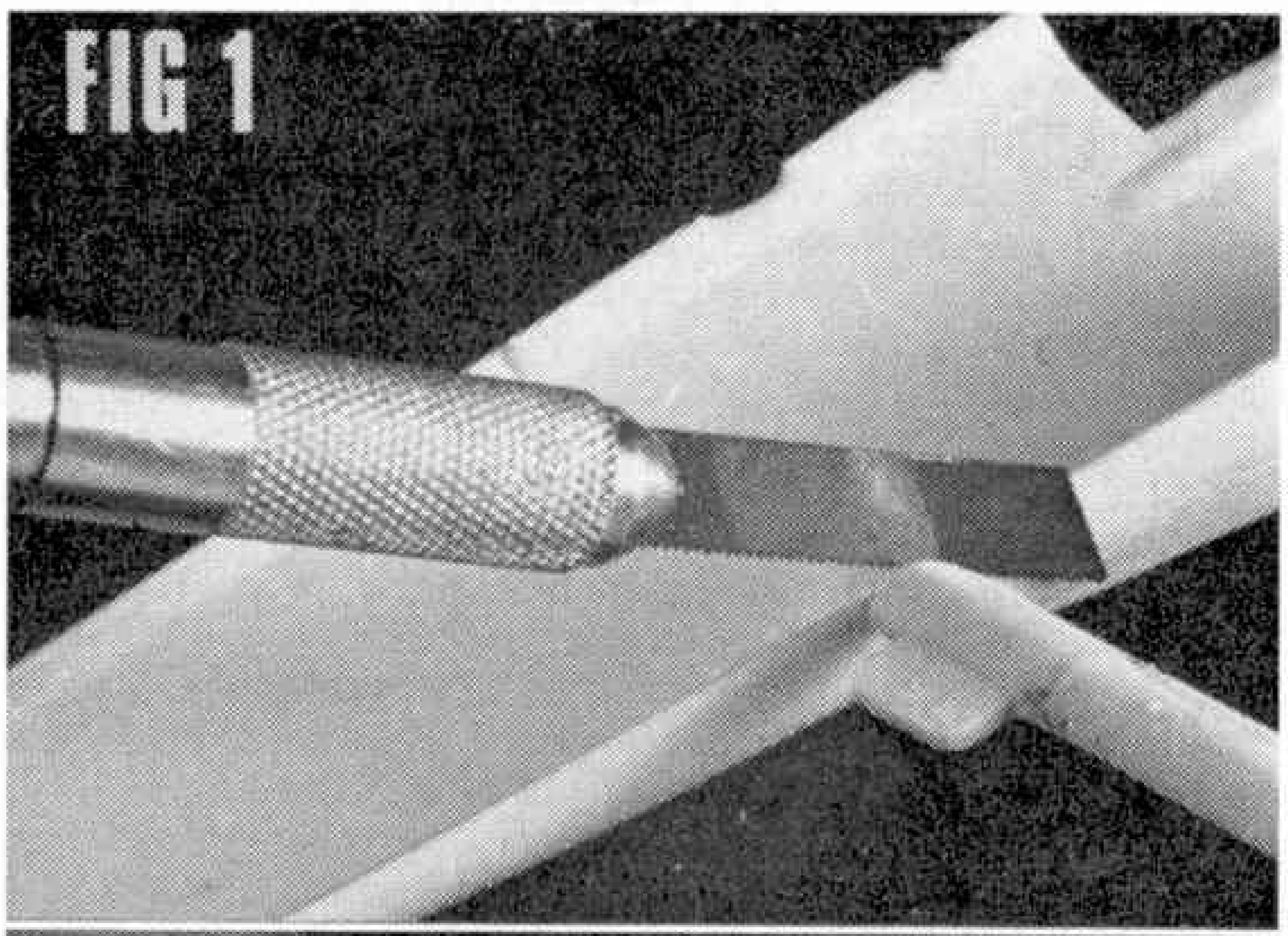


FIG 1

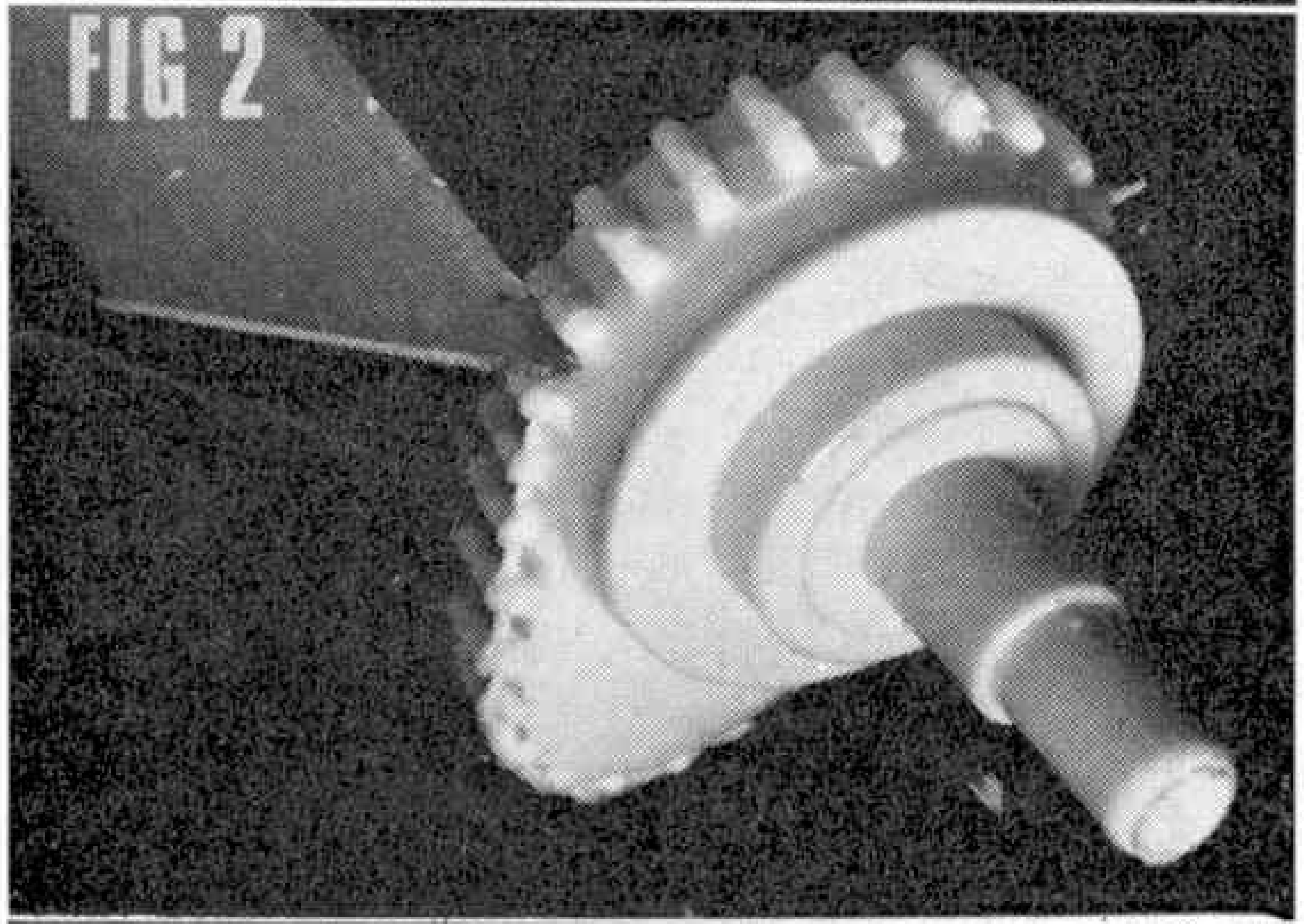


FIG 2

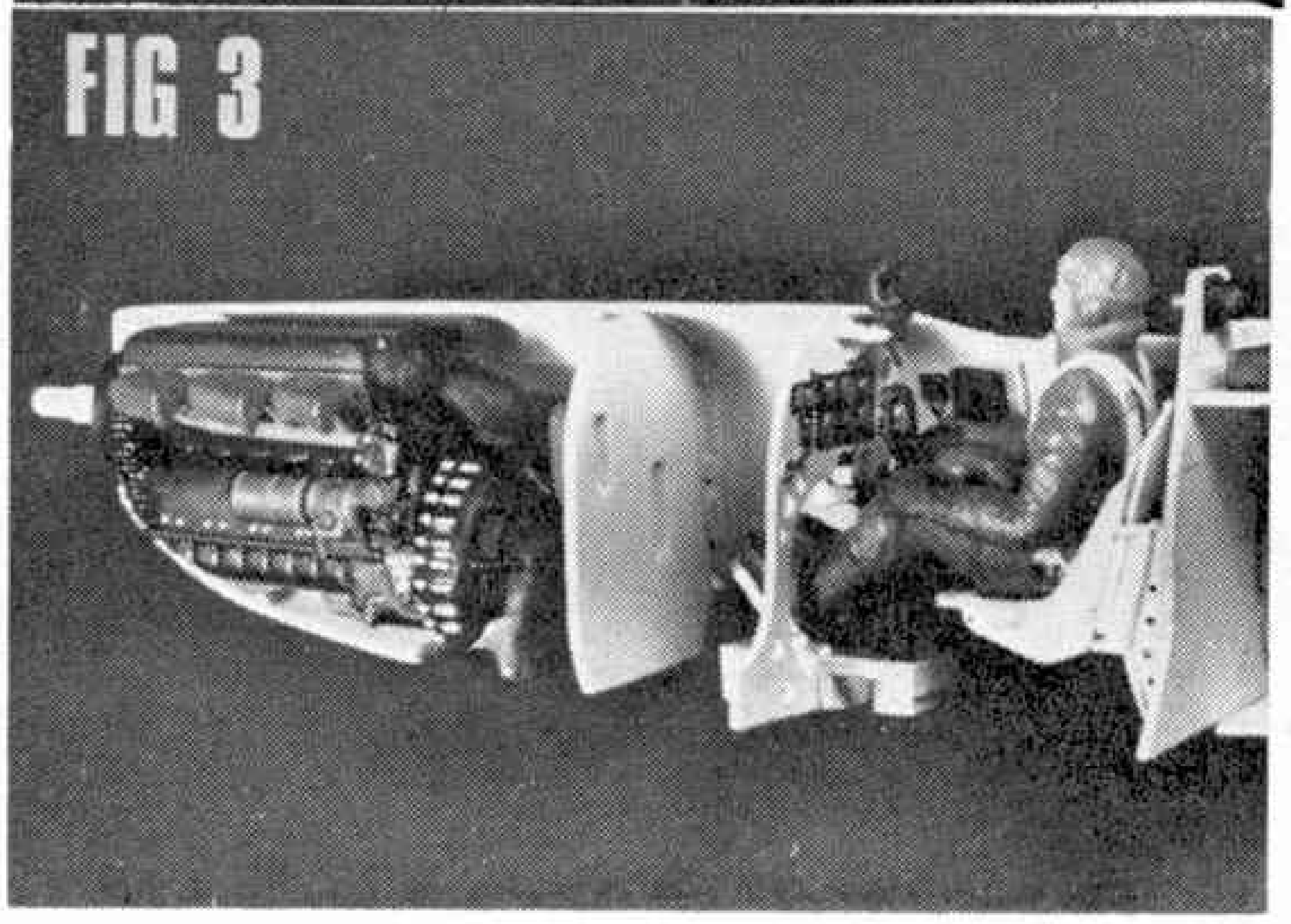


FIG 3

1 The moulding stems to the large components should not be broken off. To do so will leave an ugly scar. Best tool to use is the saw blade used in a small X-Acto handle.

2 Many parts have a small amount of 'moulding flash'. This should be removed by scraping or cutting away before assembly. This is being done here on the engine reduction gear housing.

3 The pilot is beautifully sculpted. Paint him carefully. He sits in a fully detailed cockpit behind an impressive instrument panel. Even the markings are engraved on the individual instruments.

4 The engine too is immaculately moulded. Paint it with a semi-matt black finish achieved with a mix of 75% matt 25% glossy black mixture. Pick out detail in grey, aluminium and rust (exhausts). Don't try to remove the moulding lines from the exhaust pipes—they represent the weld lines of the real thing very well.

5 Without cement, place the second fuselage side in place and hold the two halves together with rubber bands. Separate the halves slightly with the point of a knife and touch the slit with a brush loaded with Mek-Pak fluid adhesive. Capillory attraction will draw the liquid along between the fuselage halves and produce a very 'clean' join. Repeat the operation under the vase and tail and at the cockpit. Notice how the engine can still be seen through the open sides of the nose where the removeable cowl will eventually be fitted.

6 A special feature of this kit is the full retractable undercarriage. The instructions recommend assembling the wing with the wheels 'down'—we found it best to place undercarriage leg in the 'up' position *without* the wheels fitted. Don't try to work the undercarriage until the wing halves have completely set—it will take several hours.

7 We were not pleased with the fit of the wing to the fuselage, and found it necessary to remove some of the plastic from the fillet edge. This is best carried out by scraping with a sharp knife held at right-angles to the surface.

8 Some levelling-up between wing and fuselage was carried out using body putty. This material (A.M.T. is best) dries very quickly and must be smoothed onto the plastic immediately it is out of the tube. Never leave the cap off a tube of body putty—the contents will quickly become useless.

9 When dry, the putty should be smoothed with No. 400 wet-or-dry abrasive paper (use dry) as shown here. Work gently and change the paper round frequently, as it becomes clogged. The same paper is used to smooth out the joints between plastic parts, for which purpose it should be used wet. Dip the paper in water to which a *little* liquid soap has been added.

10 The Humbrol Camouflage Colour sets are the best thing to happen for the plastic modeller for a long time. After marking the approximate pattern on the surface, apply the colour with a No. 4 or 5 brush, covering in *one* coat but avoiding any build-up of enamel at the edges of the colour areas. Apply the brown first, then the green and finally the underside colour.

11 When the paint has completely dried, the transfers can be applied. Each transfer should first be carefully cut out to remove the surrounding clear film. Use a pair of sharp scissors or a really sharp modelling knife on a smooth, hard surface. The transfers are of high quality, and will faithfully follow all the surface contours to reveal the fine surface detail beneath. Press them carefully but firmly in place with a clean handkerchief.

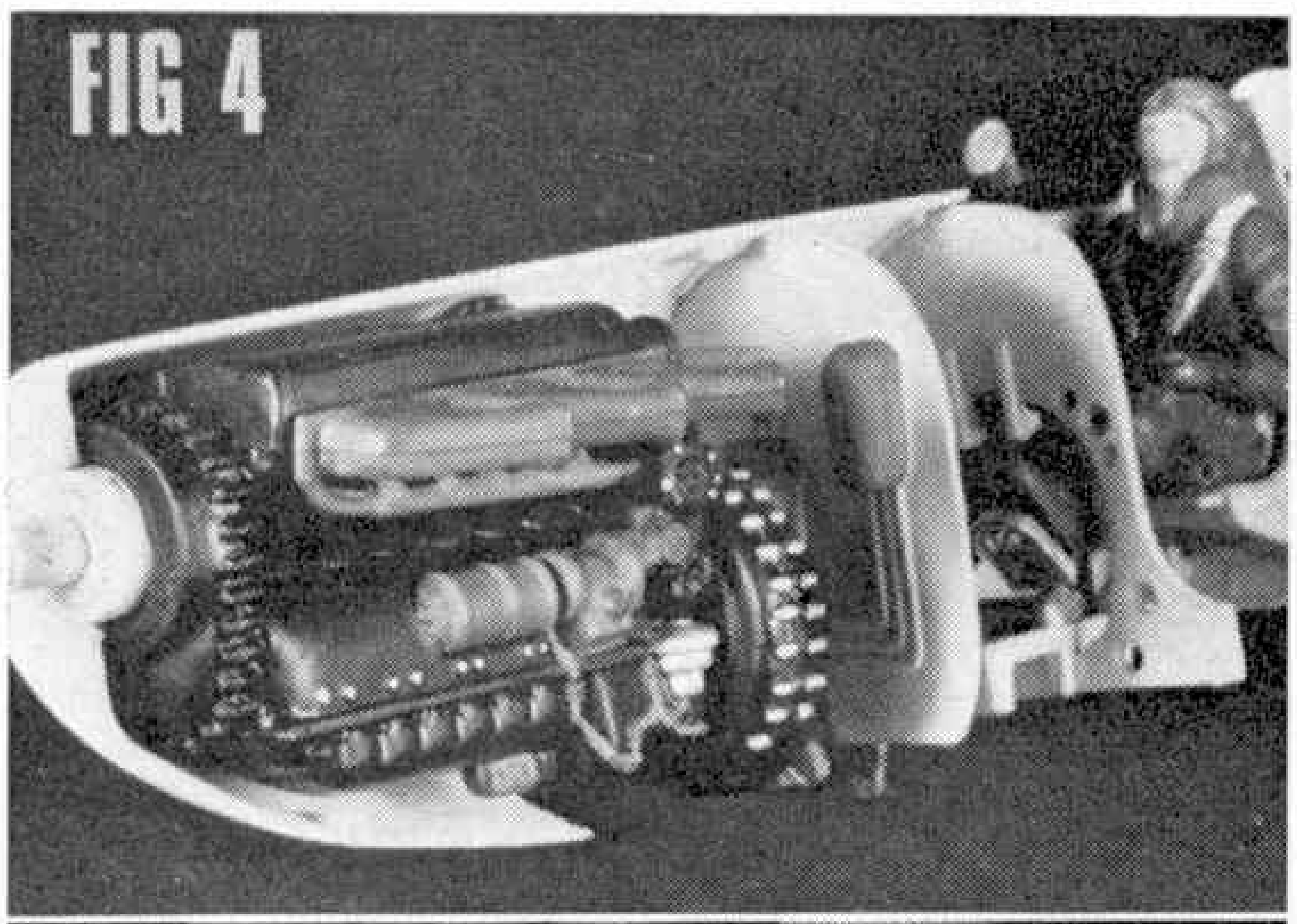


FIG 4

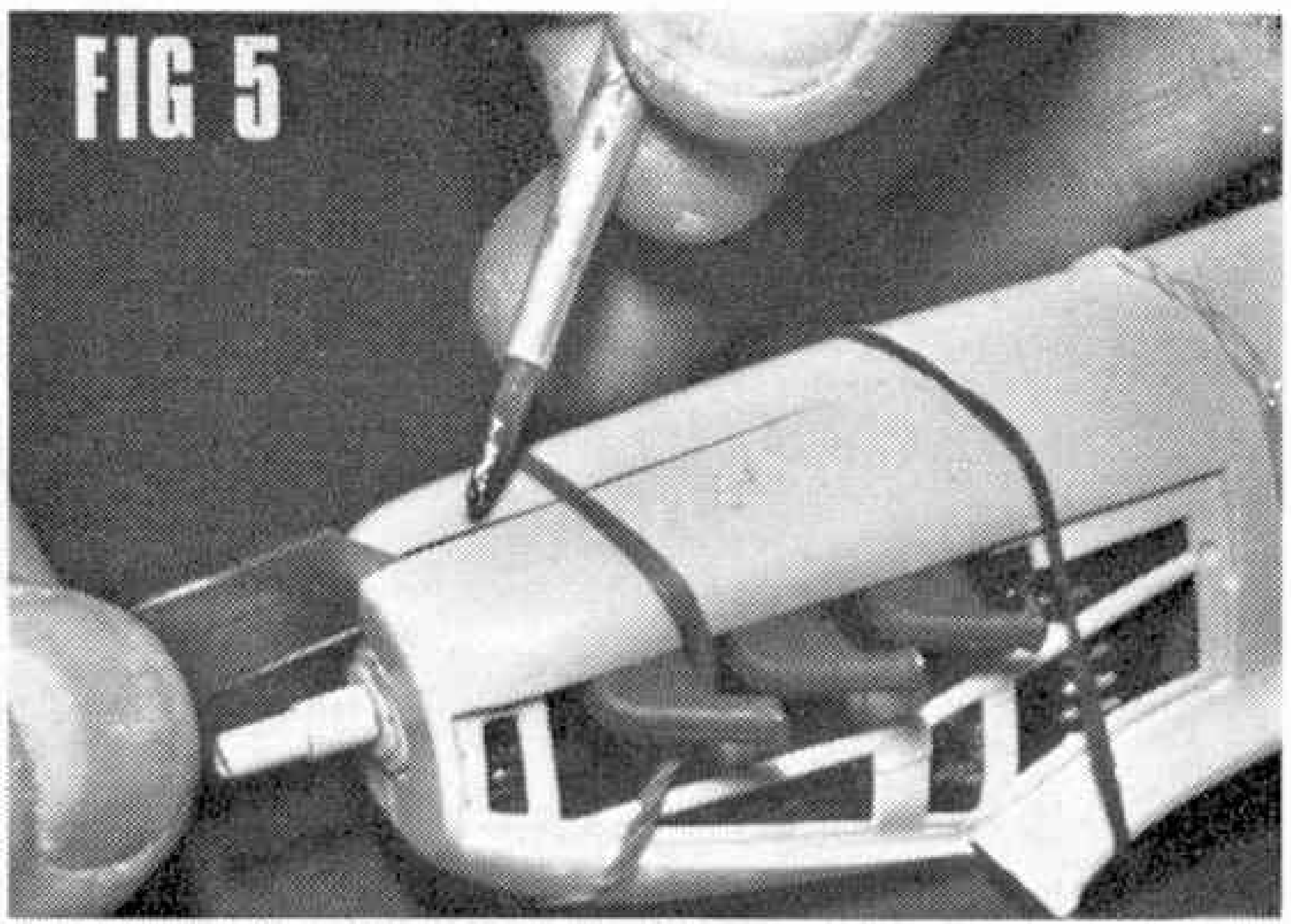


FIG 5

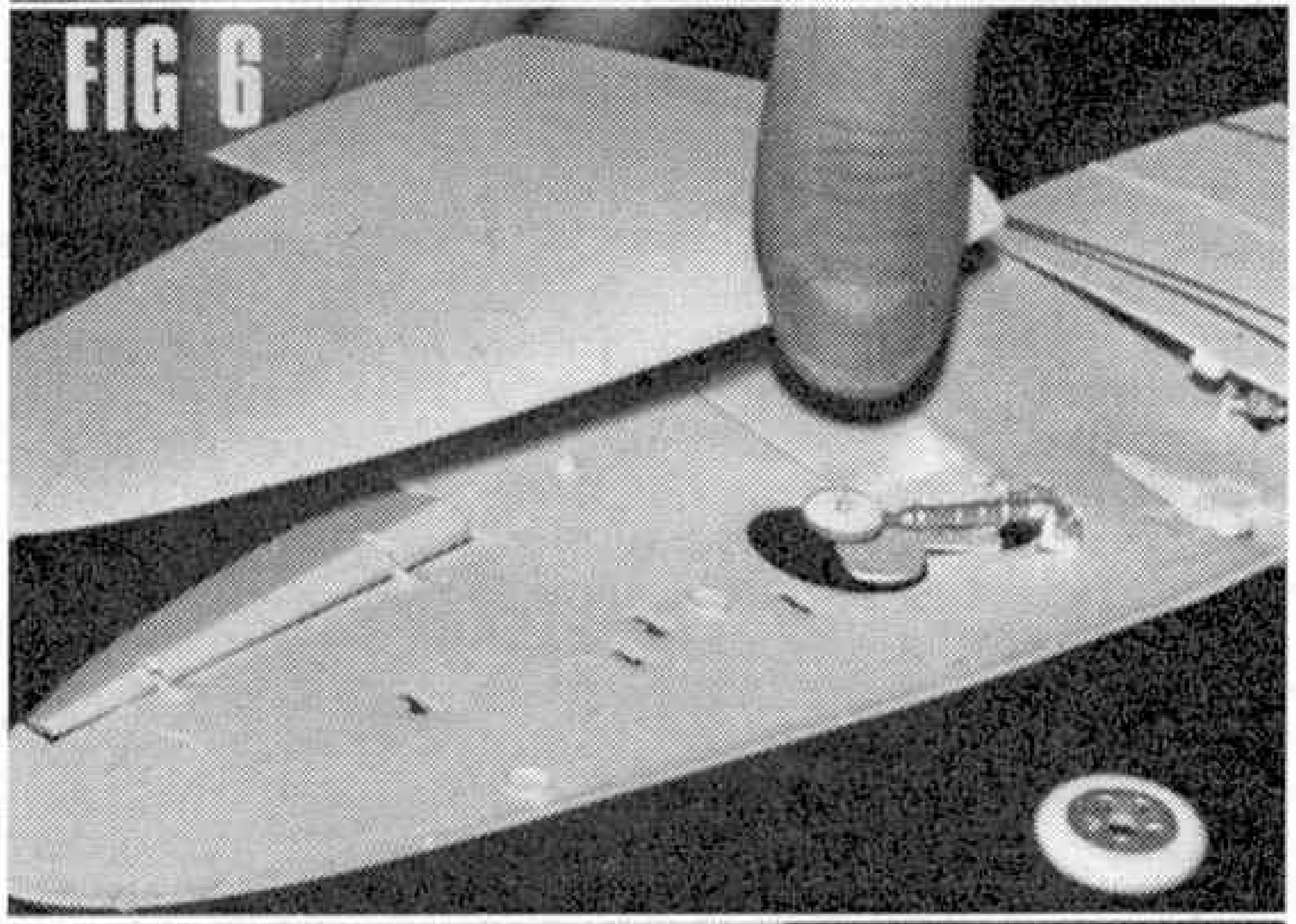


FIG 6

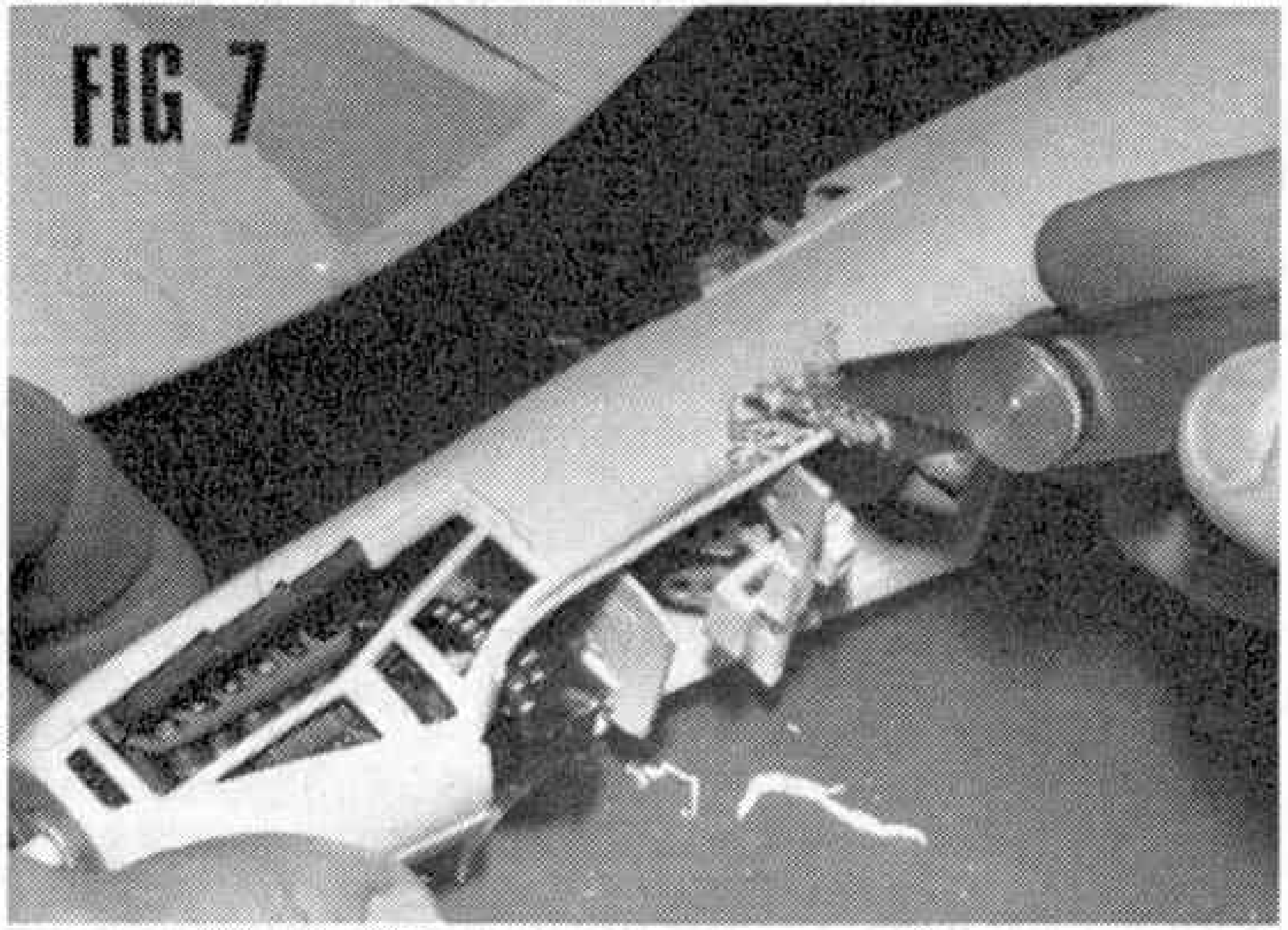


FIG 7

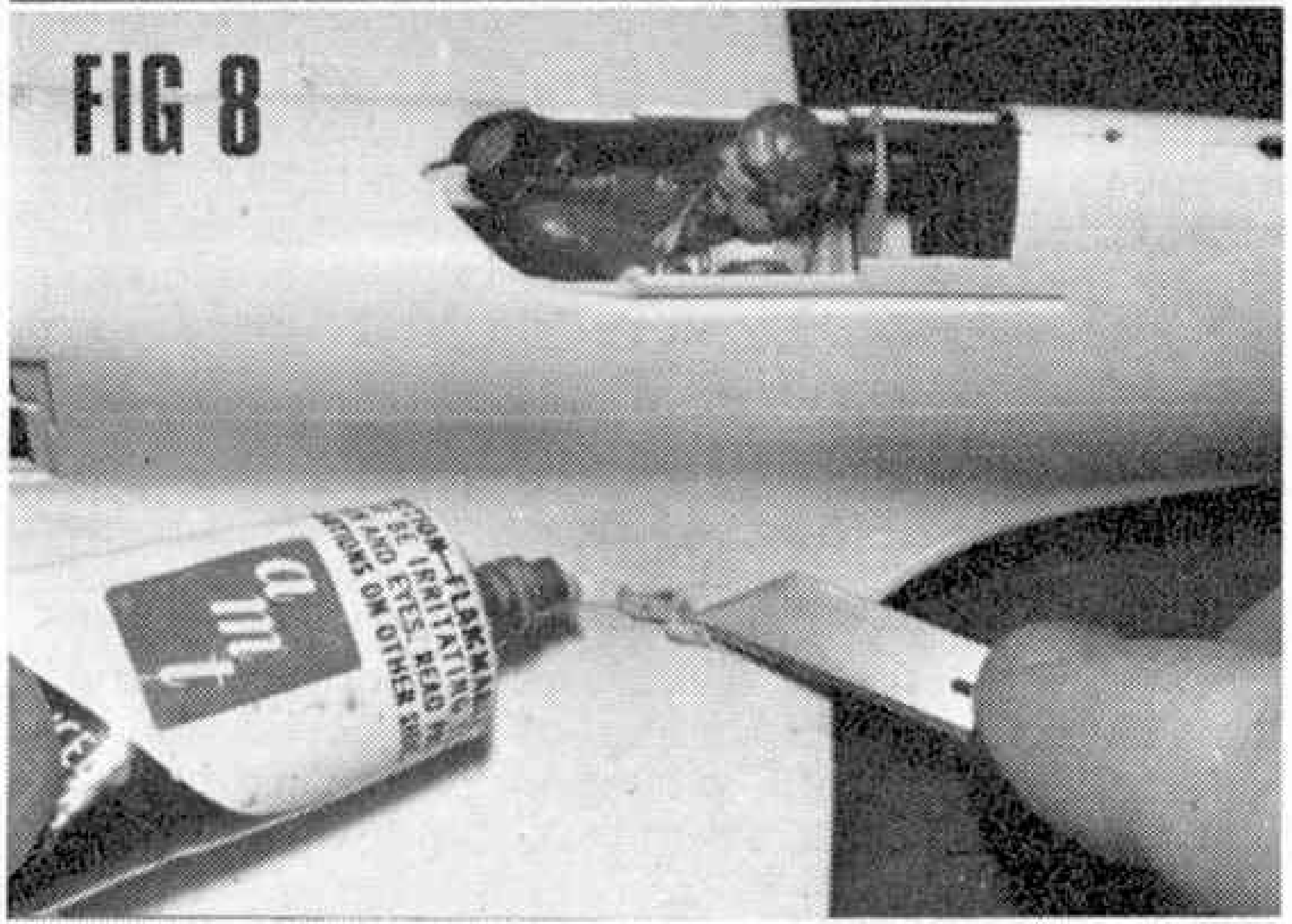


FIG 8

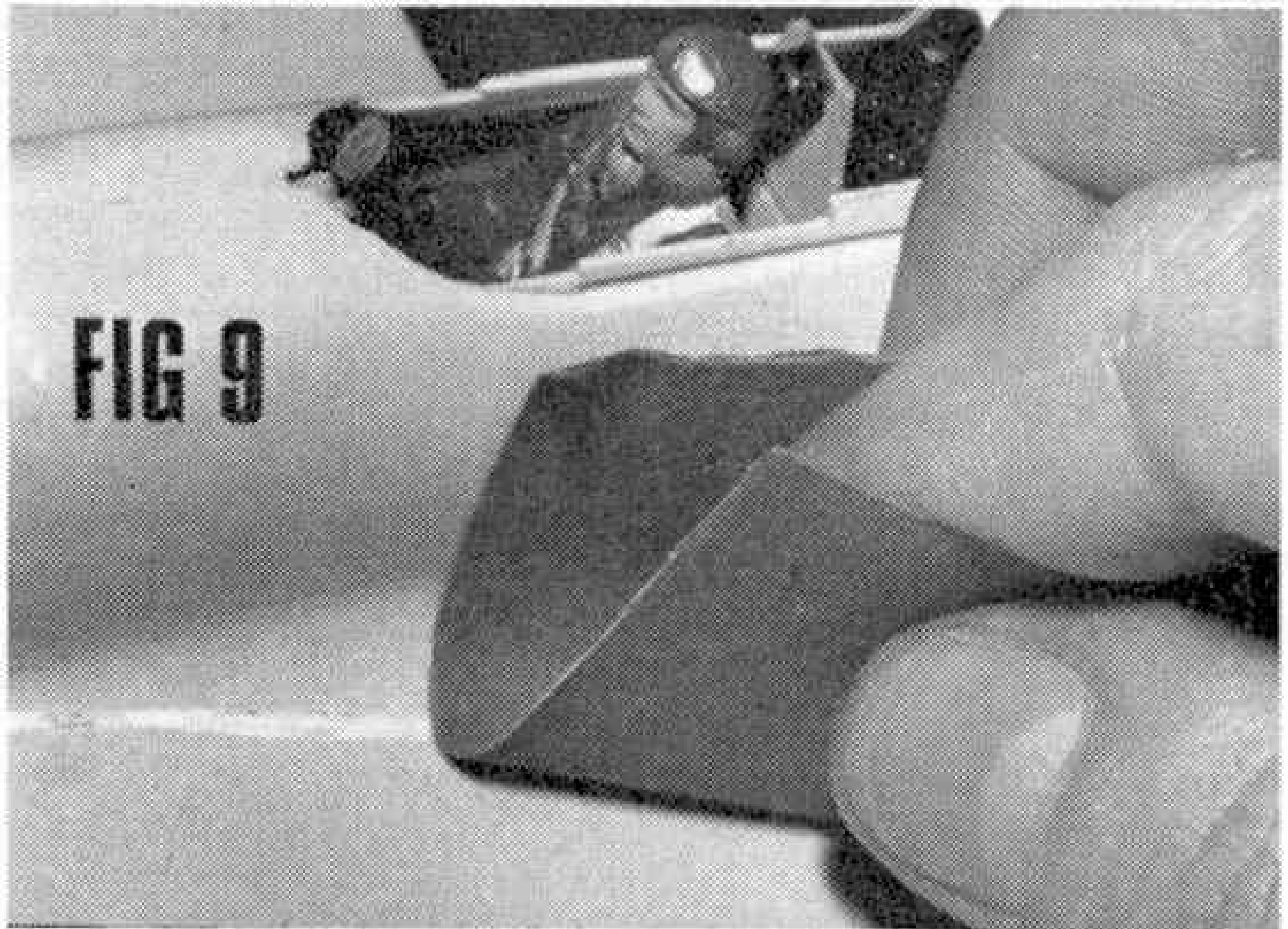


FIG 9

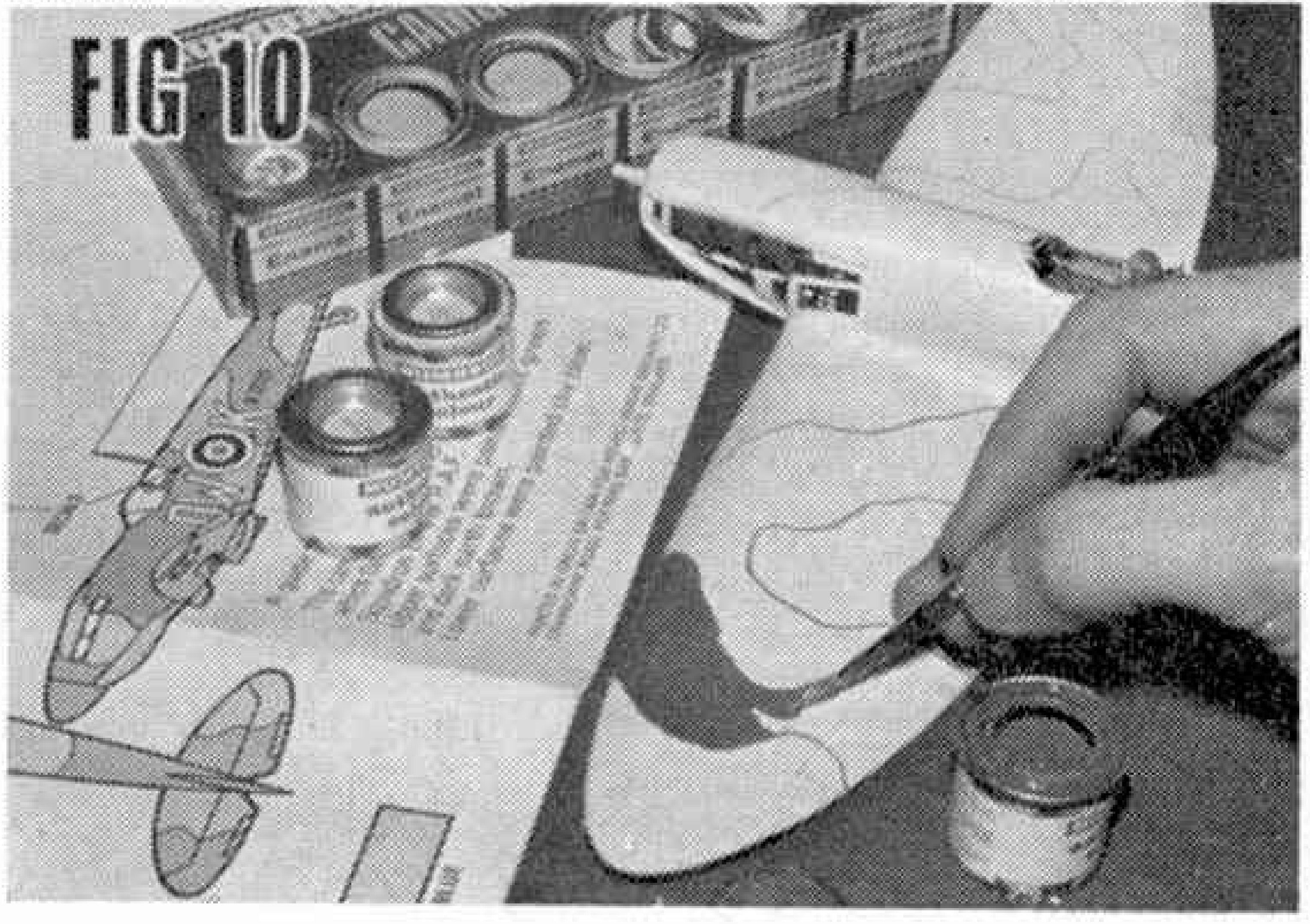


FIG 10

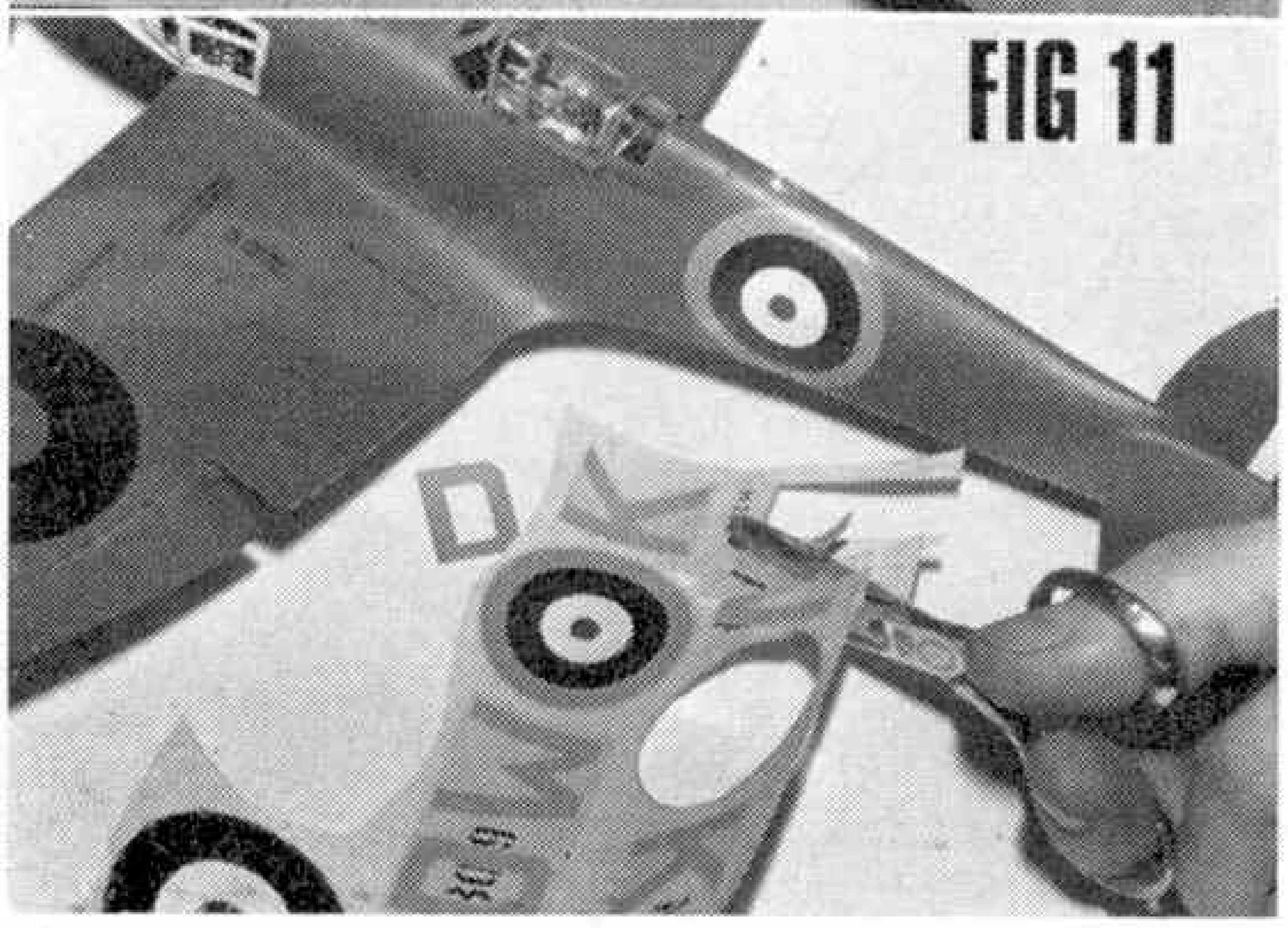


FIG 11

CONQUEST OF THE OCEANS

by Charles A. Rigby

ALONG WITH the march of progress, scientists are also studying the world's oceans more than ever, but it was not until the time of the 'Challenger' Expedition, from 1872-1874, that any serious attempt was made to find out more about them. The 'Challenger' was the first ship to be specially equipped for research, and its findings provided a basic fund of marine knowledge for oceanographers today.

Before the advent of the aeroplane, ships were the only means of crossing oceans and there were many dangers to face because they had no means of communicating with other vessels or land stations. But this was solved with the introduction of wireless telegraphy, a system developed by Marconi. At first, it could only be used for short distances, but with the spanning of the Atlantic Ocean by Morse signals on December 12th, 1901, an important step in ocean conquest was made.

Since that time with the use of short-wave radio employing morse or telephony, world-wide communication is a reality. All ships are radio-equipped, so no longer do the oceans of the world present so many difficulties and hazards. Marconi went even further for he also hit upon the idea of a 'floating laboratory', the new type of ship today. He bought the steam yacht 'Elettra' in 1920, and had it fitted with some of the first wireless equipment.

It was in this vessel that he carried on his series of experiments demonstrating the possibility of ships at sea making direct connection by wireless with the land-line telephone networks of the world, so that passengers and marine officials could speak from their ships directly to their homes or offices ashore. He also carried out investigations into the properties and behaviour of electro-magnetic waves of less than one metre in length. During his stay in England, he founded The Marconi Company Limited as it is now known, and following tradition, a new yacht, 'Elettra II' was used by the company for testing and experimental purposes. But it was not large enough for successful demonstration purposes, so a larger vessel, 'Elettra III' was commissioned.

More recently, Britain's new 'Royal Research Ship Discovery', sponsored by the National Institute of Oceanography sailed to explore systematically the little-known sea off South Arabia. One of the busiest shipping lanes of the world because of the oil trade, beyond the barest of surveys little interest had been taken in these waters a few miles from the coast. During the summer when the fierce winds of the south-west monsoon blow poor visibility usually keeps ships well away from the coast, but occasionally they strayed nearer and reported surprisingly cold waters there. So great was the abundance of algae that discoloured water was seen, besides shoals of fish, but such records were passed over with little notice. Specially designed and fitted out with all the most suitable equipment, much valuable information to shipping was obtained.

Besides dealing with the problem of vibration, laboratories were given special thought with approximately 3,400 square feet of space to cover all sorts of needs from writing, charting and theoretical work to 'rough' deck laboratories specially situated and adapted for samples brought aboard. A 'low-temperature' room is used for keeping deep-sea animals alive. Provision is also made for carrying a small portable laboratory. Besides a meteorological office with equipment for upper-air observations, there are several workshops.

For underwater work, the ship has a vertical trunk or well in the centre line, closed by a raft fitting flush with the bottom. This enables equipment for underwater or acoustic measurements to be fitted to the underside of the raft, which can be raised or lowered, so that instruments can be changed without dry-docking. For studying the distribution of fish and observation purposes, an echo-sounder and an underwater periscope are used.

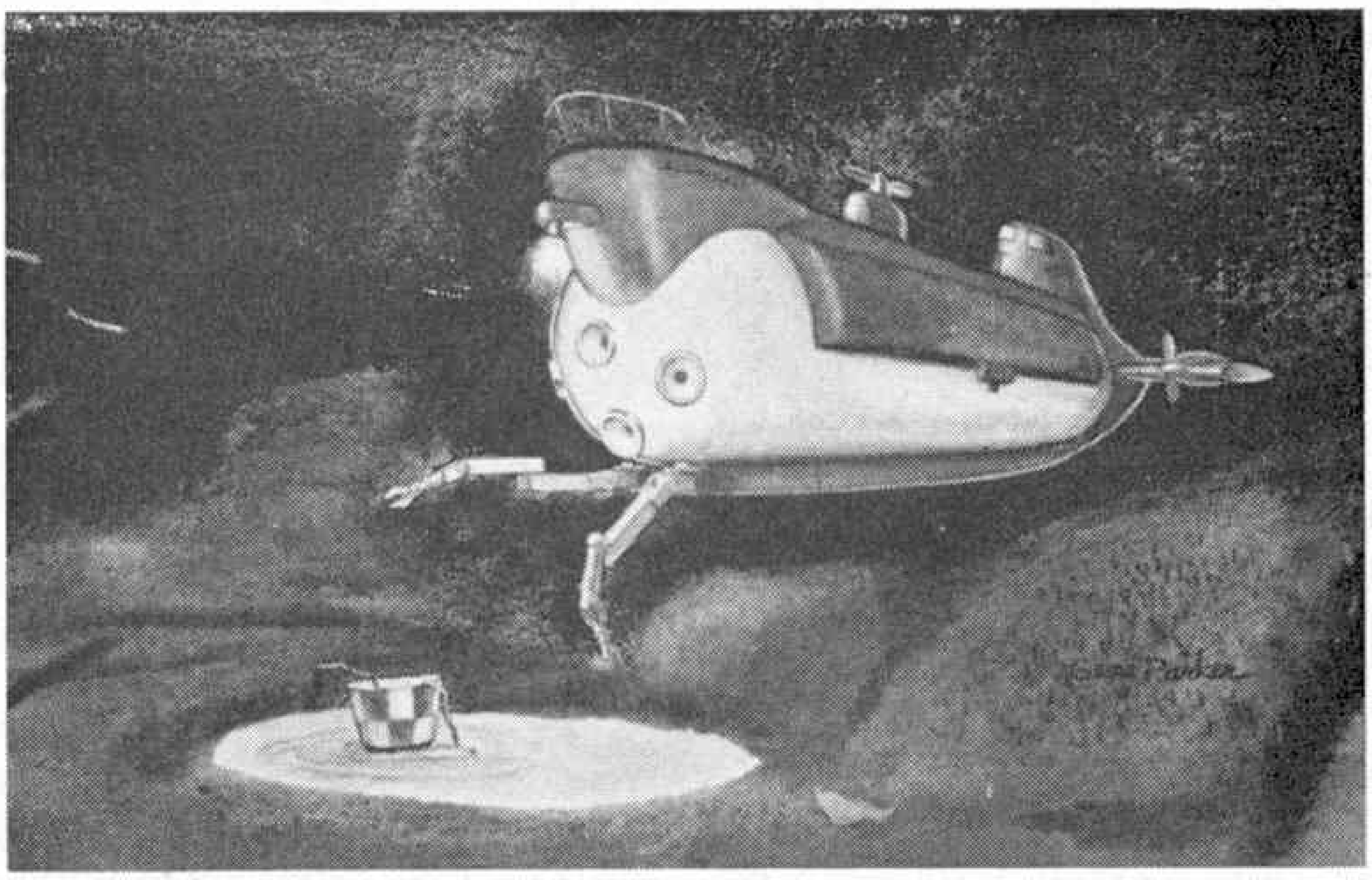
Among the equipment used are various trawls and nets for use at various depths varying from shallow water to great depths, an under-water camera, and bottles for water-sampling purposes, a series of these being used to sample water at known depths between the surface and the ocean bottom. Winches are also used for lowering both light and heavy equipment into the sea, samples of water being obtained by attaching each bottle to a hydrographic wire.

'Discovery' sailed from Plymouth on June 1st, 1963, and after a brief call at Aden began her survey, which consisted of a series of lines of observation in a zig-zag pattern along the Arabian coast, covering roughly an area of 100,000 square miles. The observations consisted of a full series of meteorological readings, measurements of the temperature and currents at different depths, estimation of the chemical properties of the water, collection of plants and animals both in the water and on the sea-bed, and observations of birds, whales, etc. The acoustic equipment was used to detect the presence of fish shoals and concentrations of other animals in the sea.

Exploration continued for several months, well on into 1964, useful evidence of ocean circulation being obtained by observing how quickly the currents and slope of the density layers change with the monsoon winds. The sequence of events which take place when nutrient-rich water upwells from the deep layer provided valuable biological data, and the changes in monsoon winds were studied in relation to the interchange of energy between ocean and atmosphere. Problems in chemistry and physics were also pursued. On its return, later, 'Discovery' began research in the North Atlantic Ocean, making observations designed to increase our understanding of the ocean and its physical, biological and geological processes, because of their application to navigation, fisheries and waste disposal.

Besides ordinary sailing vessels, the American submarine 'Aluminaut' has been put into service for carrying out salvage work on the ocean-bed, mineral prospecting, and a variety of other under-water tasks. The vessel has a pair of nine-foot-long mechanical arms to enable it to move around the sea-bed like a giant monster. The huge arms protrude from the forward end of the keel, and have full freedom of manipulative action. They move vertically or horizontally at the shoulder and horizontally at the elbow, while the wrists can both twist and bend and the hands grip like lobster claws. Each limb, even when fully extended, has a lifting capacity of 200 lbs. at depths down to 15,000 feet.

The operator, at a portable console inside the submarine has complete visual control from any of four portholes and can also monitor operations on a TV screen. The huge arms presented a new problem which



This artist's impression of the submarine Aluminaut prowling the ocean bed on research, exploration and salvage missions. Nine foot long mechanical arms give the vessel a bizarre sea monster look and will enable it to perform tasks other undersea craft are incapable of. Photo: General Elect. Co., New York.

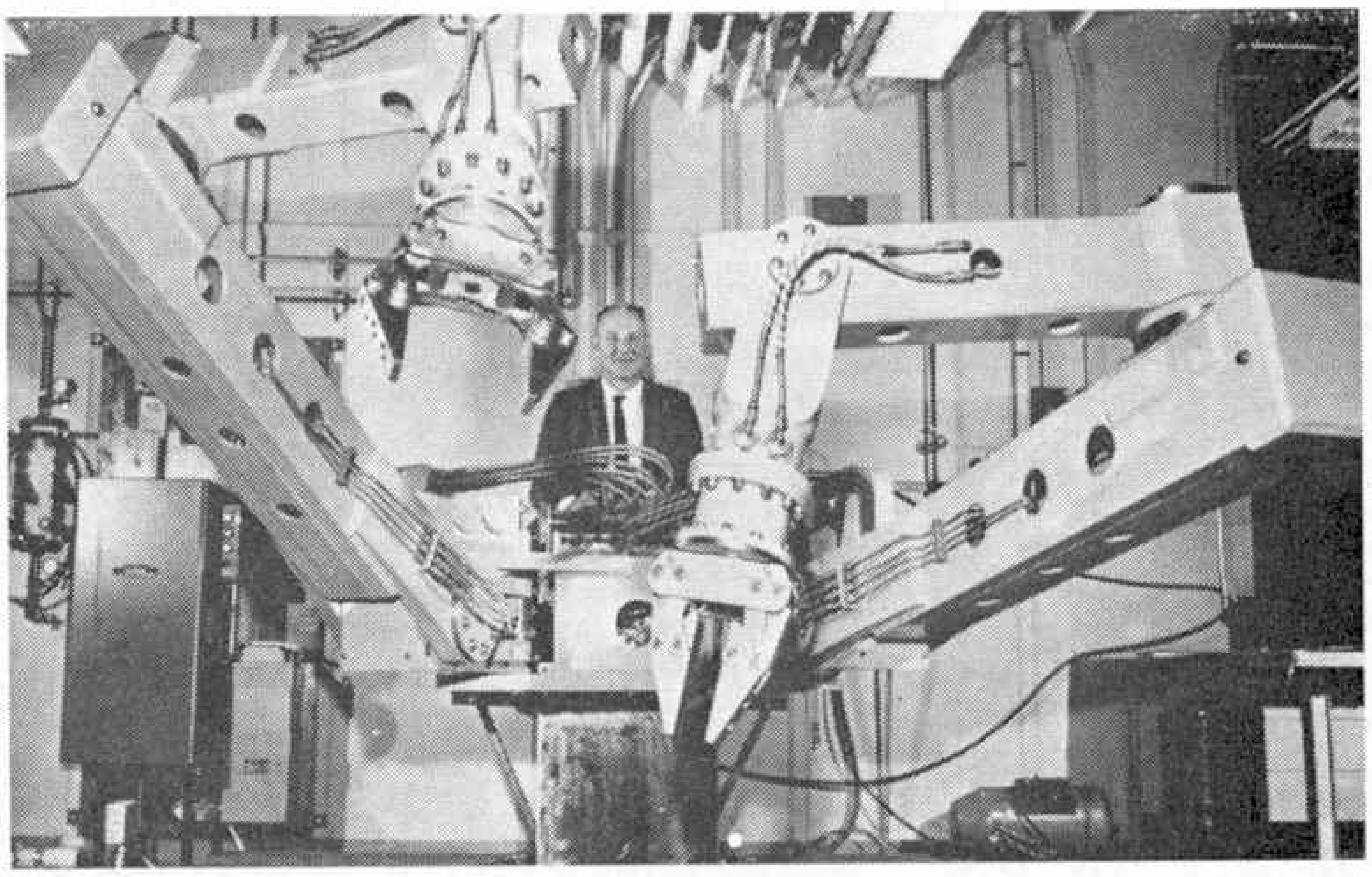
had to be overcome, that of equalizing the pressure differential inside and outside the vessel to permit operation of the hydraulic system. 'Jep Tide' another American vessel crammed with high-powered electronic equipment is 'plumbing' rock strata beneath South Africa's east coast continental shelf, in search for gas and oil deposits. This 150-foot long vessel has a method of seismic survey said to be the most modern yet devised. It hinges on high-powered electronic impulse vibrations directed at the sea floor by special devices.

South Africa is also taking a vast amount of interest in oceanographic research. Lately, the 'Meiring Naude' research ship was completed for the Council of Scientific Research (CSIR), the biggest vessel of its kind to be built so far, being 104 feet long, and having a displacement of 320 tons. The vessel is fully equipped for the scientific role she is to play in South African territorial waters, particularly off the coast of Natal. Besides a crew of 13, there are eight scientists.

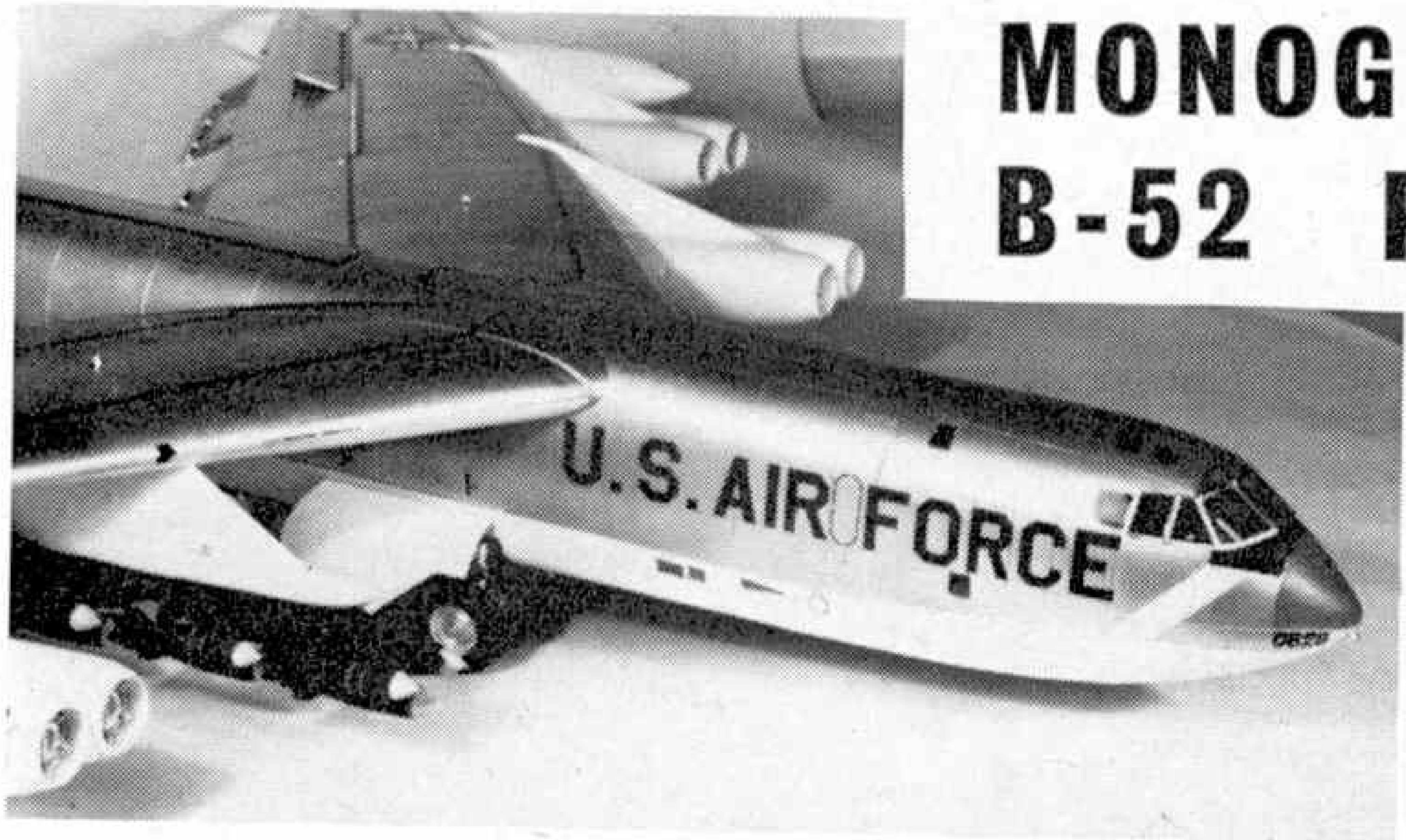
Among her oceanographic assignments are the surveying of the continental shelf and slope measurements, and the plotting of currents, water temperatures and densities, prevision depth recording, magnetometric measurements, ocean bottom photographs and the sampling and measurement of bottom sediment thickness. It is also to be used for such tasks as studying sand movements along the Natal coast which might influence harbour planning, conducting basic marine biological research and studying the pollution of the ocean by effluent discharges. Again, South Africans were the first to explore a large undersea mountain 35 miles across the base and rising to 15,000 ft. to within 114 ft. of the surface. Known as 'Seamount' Vema, it is 540 miles W.N.W. of Cape Town. The oceanographic vessel 'Vema' of the Lamont Geological Observatory in New York had discovered this mountain in 1957.

Russia, too is taking much interest in ocean research but not much is reported. However, apart from her fishing fleets believed to be so well equipped with radar and other aids, there are certainly other special research vessels, for in 1961, the 'Vitiaz' reported finding concentrations of hydrogen sulphide between 300 and 3,000 ft. in the Arabian Sea, where the British ship 'Discovery' carried out her research. But not much was found during this survey, this being believed to be a product of the decomposition of the large quantities of plankton produced while upwelling was in progress.

Man is devising new and better ways of exploring the sea-bed. Step by step, more and more is being found out about the oceans of the world. Never has there been a time of so much activity in oceanographic research.



An engineer demonstrates the operation of the huge mechanical arms developed for use on Reynold's International's "Aluminaut" submarine built of aluminium. Nine feet in length the arms are each capable of six different motions and can lift as much as 200 lb. at depths down to 15,000 feet. Photo: General Elect. Co., New York.



MONOGRAM'S GIANT B-52 PLASTIC KIT REVIEWED

by Ray Howlet

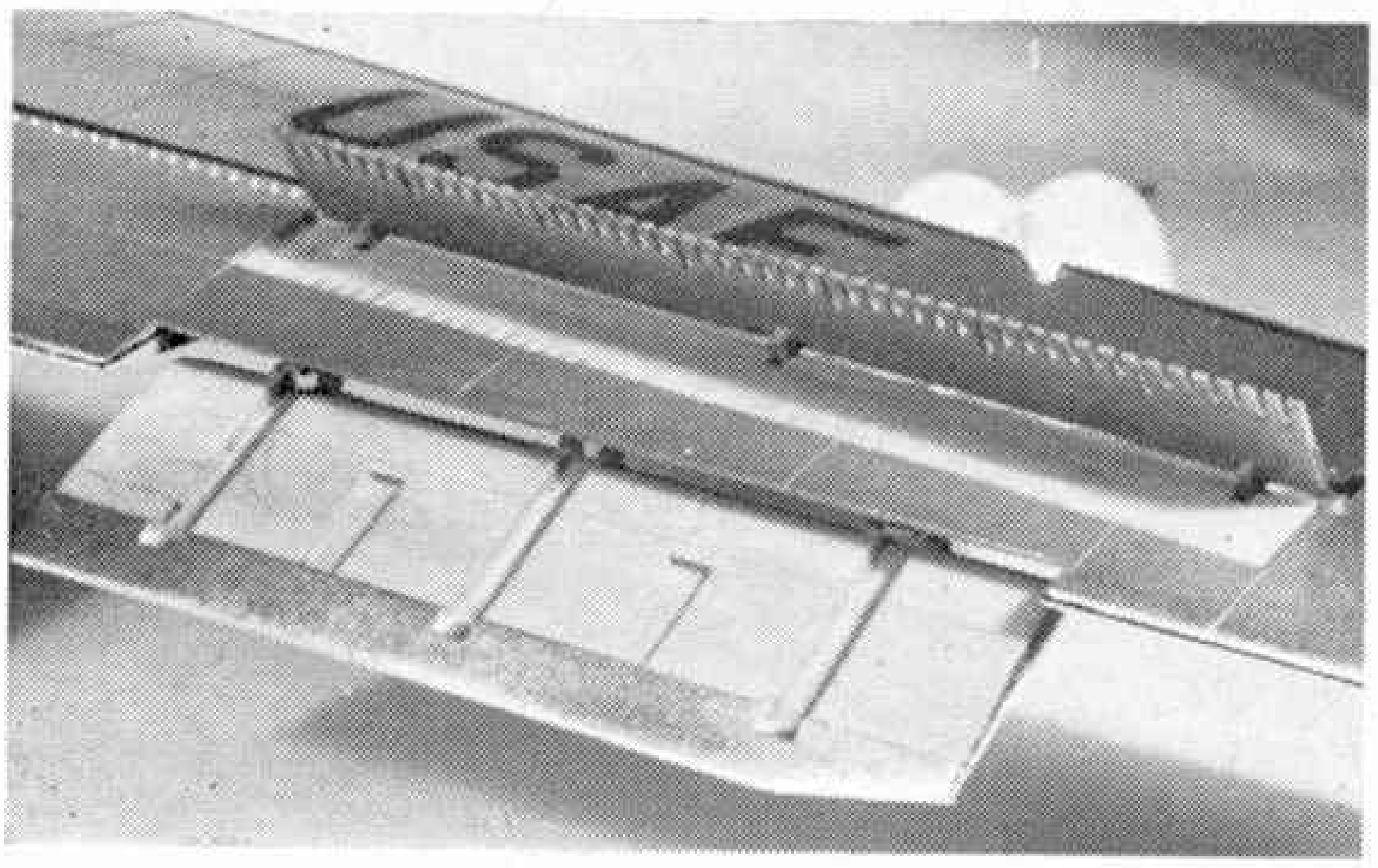
31 in. wingspan, 26 in. long with jet engine sound unit and a very well moulded plastic kit

IN JULY 1948 the United Air Force awarded a contract to the Boeing Company for two aircraft to be designated XB52. From this contract came the largest inter-continental bomber to be flown by any Western power. After seven years of development the B52 entered service with the U.S.A.F. Strategic Air Command and by December 1956 the model "D's" were being delivered to bomber squadrons.

This giant eight engined bomber with a range of 6,000 miles, flys at nearly the speed of sound, its wings span 185 ft.; almost twice that of the World War II Boeing B17 Flying Fortress, and it weighs 225 tons. This has become the subject of the largest model aircraft plastic kit ever, from the U.S.A., as Monogram have produced an outstanding 1/72nd scale model B52D with a wingspan of over 31 inches and fuselage length of 26 inches.

The kit has many outstanding features, including detailed cockpit, crew members, opening crew door, moving external bomb doors, movable rear gun turret, wing flaps and jet engine sound, it is well moulded in dark green plastic to the usual Monogram high standard. The kit appears at first to be constructed in the same way as any other plastic model but in the early stages of assembly it was found that great care is needed. Some of the things we liked about the model was the landing gear assembly, which had good strong legs that fitted easily into slots in the fuselage and the moving bomb doors which also fitted with no gaps and operated well, as do all the movable features.

Because of its size, when final assembly of the fuselage is reached, extra care and perhaps some help is called for, but once cemented the fuselage becomes very strong and can be prepared for painting without fear of damage. Wings, engine nacelles, fin and horizontal stablizers are quite straight forward in construction and when the joints are cleaned up they become almost invisible. An extra nacelle with a spare jet engine is included with the kit, to be assembled as a display piece in the open position.



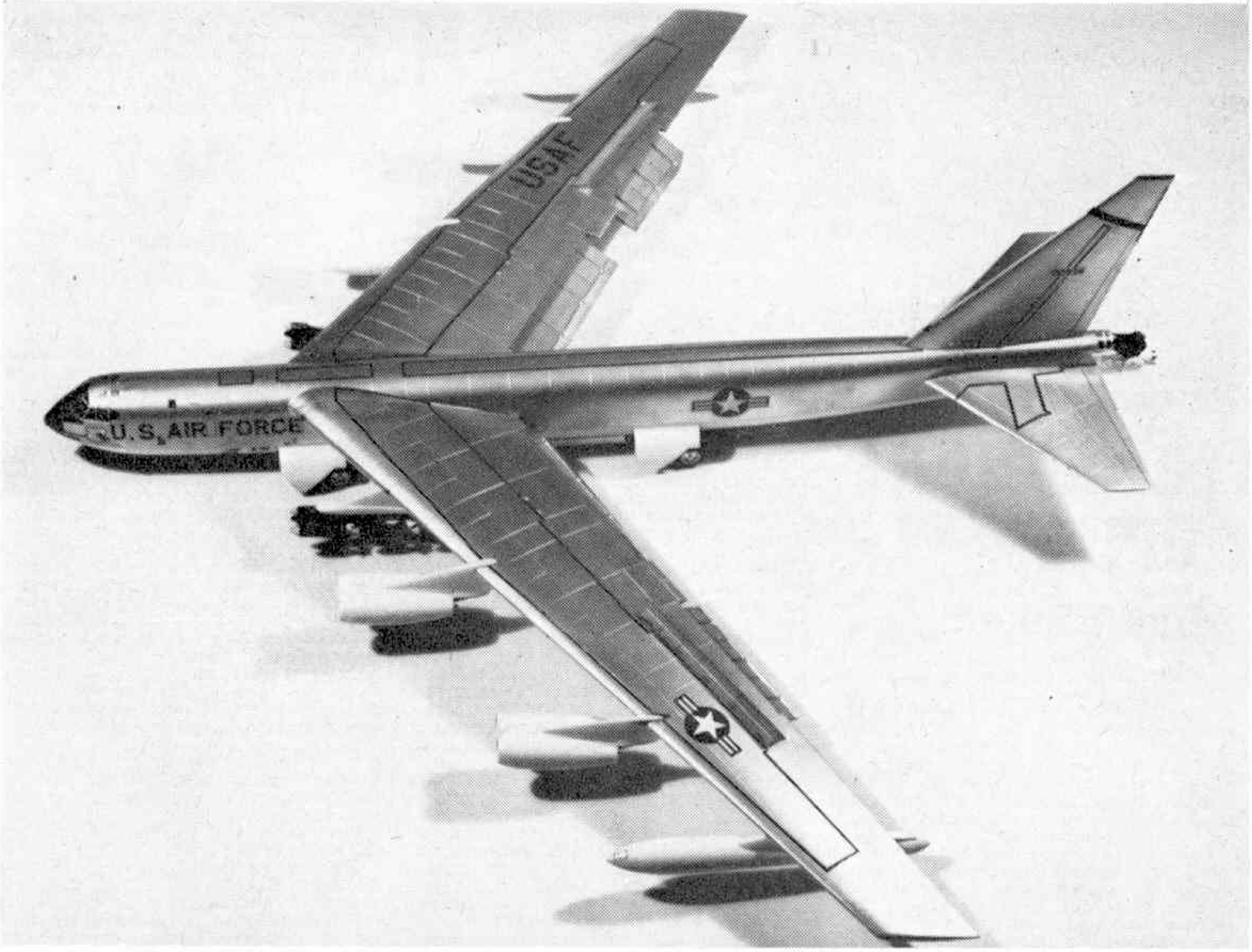
At this point let us look at some of the things we did not really like on our B52. Jet engine sound comes to mind first, as this appears to be just a gimmick and it might have been much better left out, for it does not really sound authentic and full bomb bay detail could then have been included. As it is it is used to disguise the battery box. Fuselage bulkheads could also have been included for one can see right through the wheel wells down the fuselage length, and outrigger wheels are moulded to the legs, not separate.

Painting your Stratofortress! Decided on the suggested alternative S.A.C. or Vietnam colour schemes. We chose the S.A.C. scheme with white underside, silver upper surfaces. Without a doubt the only way to paint this model is with a spray so we used 'Belmont Enamel Spray' matt white and metalic chrome. Although the painting instructions are very good, here are a few tips on spraying your model. Wings, tail stablizer undersides along with engine nacelles and tanks are best sprayed separately. The fuselage underside should be masked, and the metallic chrome applied after the white has thoroughly dried and has been masked completely. At this point small details, i.e. nose radome, anti-glare, nacelle cones, etc., may now be painted.

The transfer sheet is very good but lacks walkway stripes for the wings and fuselage upper-surfaces, plain black transfer cut into thin strips overcome this problem very effectively.

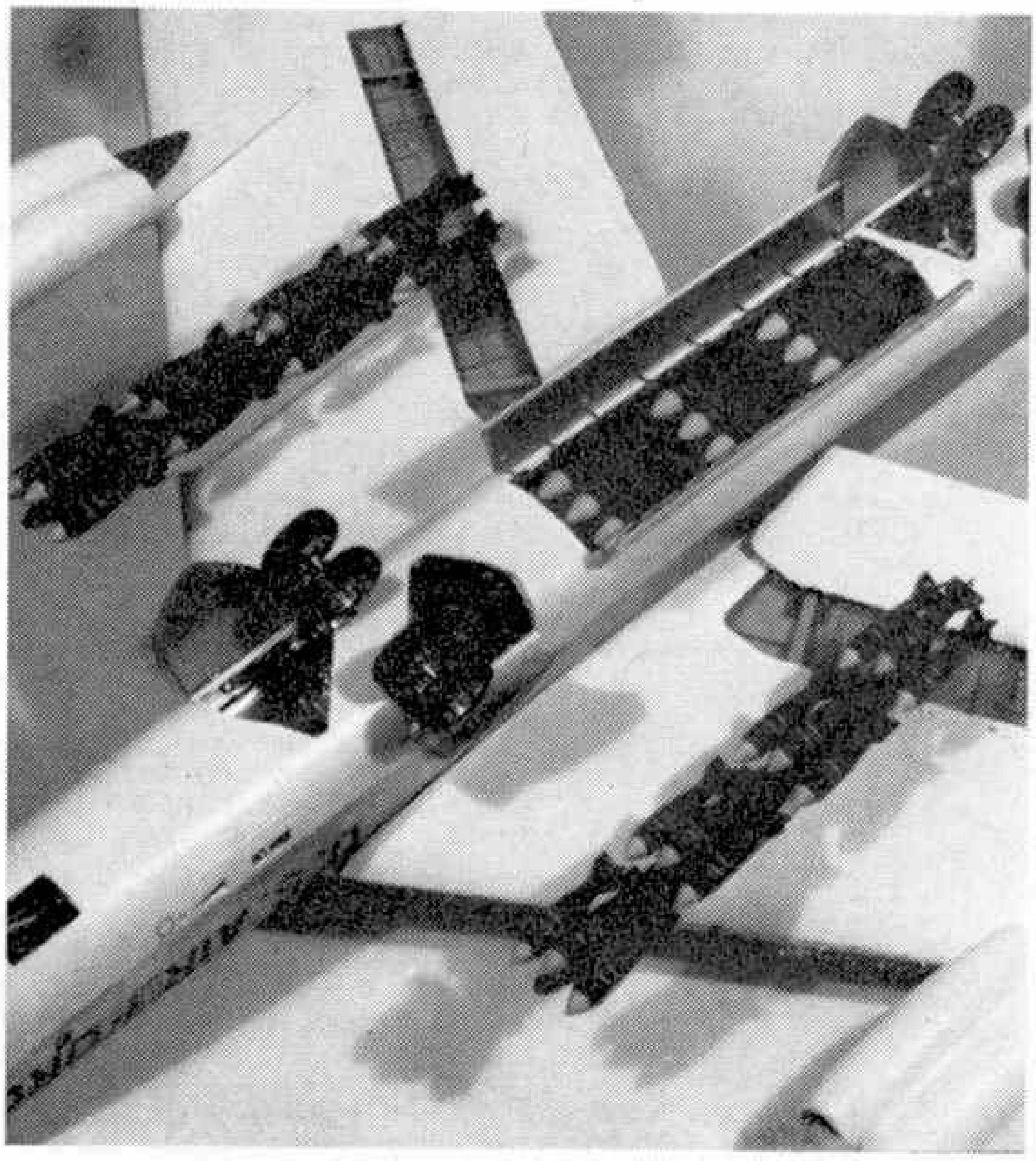
To generally sum up on Monograms B52 Stratofortress, one feels they should be congratulated on the great achievement in producing a kit of such size so accurately, but a little more detail, such as separate rudder, elevators, outrigger wheels and interior perhaps could have been added. This impressive model, which unfortunately retails at £11 19s. 6d. is ideally suited for modellers who have generous relatives or an understanding wife.

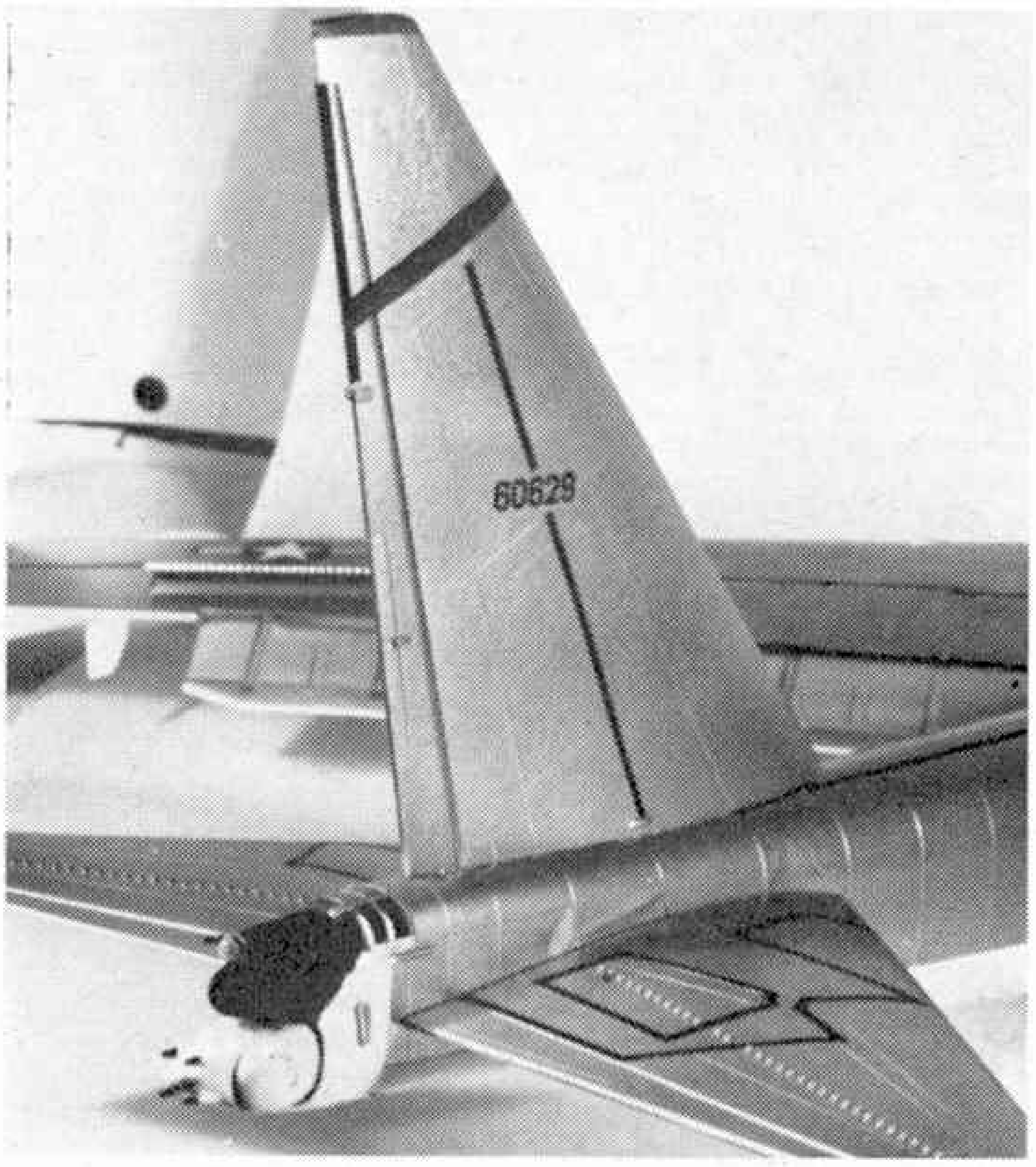
Above top: The cockpit frames are lined with silver paint, the nose randome brown, bombs olive drab with yellow bands and noses, also S.A.C. flash visible below cockpit. At left: The lift spoilers are hinged on plastic arms, the flaps slide in and out on channels, all the inner surfaces are zinc chromate.

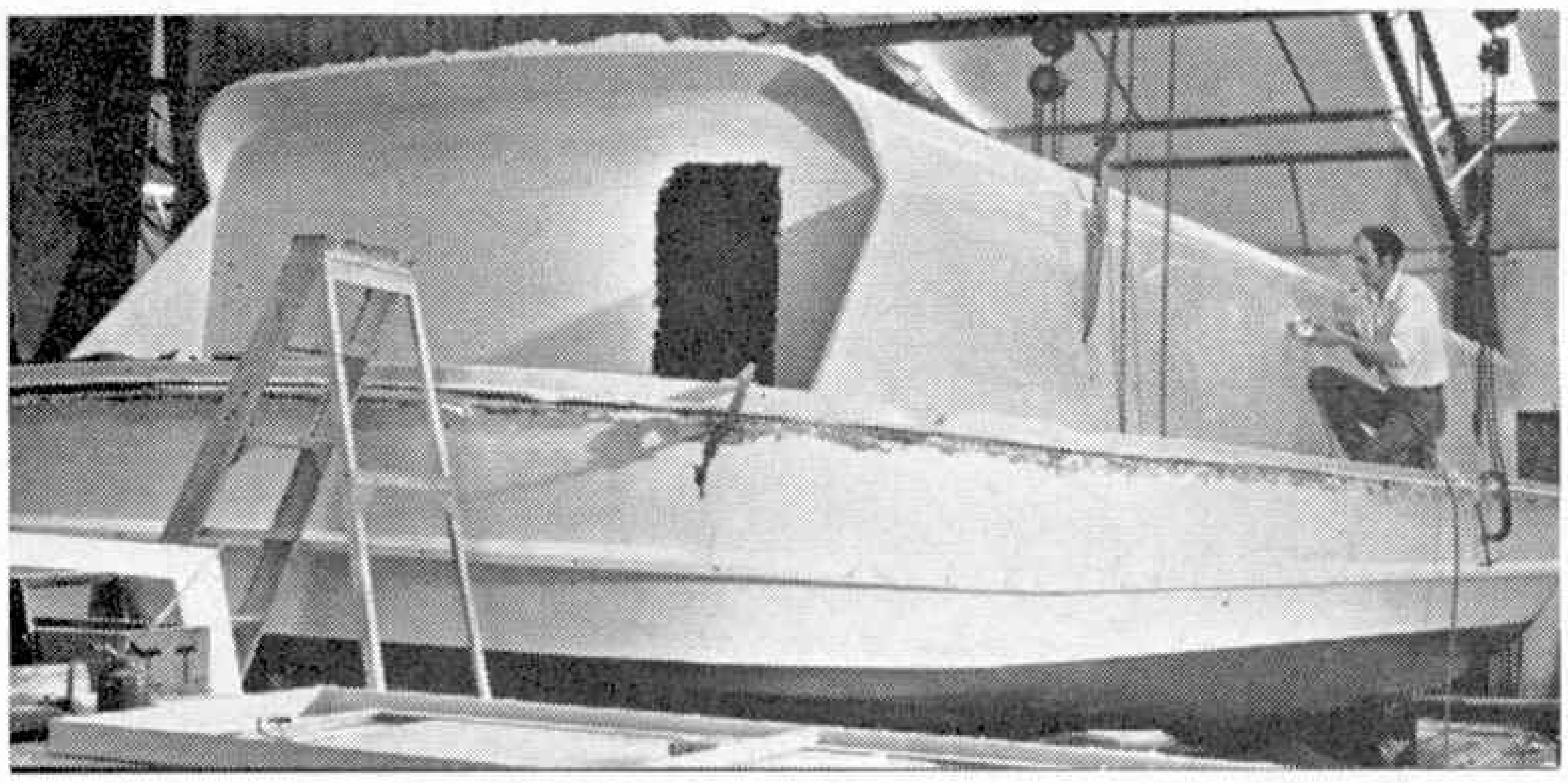


Below: The landing gear in the down position. This is painted silver and black. The bomb doors are hinged in the open position and the bombs visible. The external racks have 24 bombs fitted into angled slots.

Below: The rear turret swivels up and down as well as from left to right. The gunners compartment is also visible with the black walkway lines on the upper tail surfaces. The rudder is also movable.







A four inch diamond disc fitted to a Downland pneumatic trimmer cuts out the cabin windows on a Caribbean river cruiser. This device saves the constructors four days production time and causes less fibre dust to be spread around.

TRANSPORT TOPICS by

Mike Rickett

REMEMBER THE mystery lorry we mentioned and illustrated in the last edition of "Transport Topics"? To satisfy the curious among you, this was in fact built by British Leyland and is different to practically every other type of lorry in that it is powered by the unique Leyland Gas Turbine engine, instead of the more conventional petrol or diesel piston engines normally used.

Gas turbine engines are not in themselves a particularly new innovation. Aircraft have used them for many years with a great deal of success, and the problem has been how to use an engine that normally occupies a great deal of space, in the confined room available in either a commercial vehicle or a private car. Rover solved the problem with their 200 hp two-shaft turbine engine used in the "Jet 1" car which set the first world speed record for turbine cars in 1952.

In all, over a quarter of a century of experiences lies behind the new gas turbine engines, developed by a team of engineers internationally recognised as leaders in automotive gas turbine technology, a team which also designed the Rover-BRM car which competed, with success, at Le Mans in 1965. In the early 1950's, Leyland Motors and Rover collaborated in the early development of gas turbine engines for military purposes and when the Rover Company became part of Leyland Motors, a new gas turbine organisation was formed—Leyland Gas Turbines Limited, which has since concentrated exclusievly on the development of the advanced low cost 350/400 hp gas turbine engine which forms the power unit for the Leyland Gas Turbine Truck.

How, you might ask, does a gas turbine engine work anyway? Well, the basic operations are the same as in any other internal combustion engine; namely induction, compression, expansion and finally exhaust. In the piston engine these all take place in the cylinder, but in the gas turbine, they take place at the same time in different parts of the engine. There is just a specialised component for each operation and power production is continuous, unlike the piston engine where it is not.

It is difficult not to become rather technical, but basically, air drawn into a compressor is expelled into a combustion chamber which also has fuel sprayed into it. The fuel and air mixture burn, and its temperature is raised so that the gas is expanded through a first turbine where sufficient energy, in the form of temperature and pressure, is removed and converted into mechanical power to drive a compressor mounted on the same shaft. The remaining pressure-energy can be expanded either through a propulsion nozzle, as in a jet engine, or through a second turbine to convert it into mechanical power. A considerable temperature-energy is left in the gas when it leaves the second turbine and this would obviously cause a great deal of damage if allowed to leave the engine on our roads. This problem is solved by fitting a heat exchanger, which extracts all the surplus heat, which it uses to increase the temperature of the compressed air before it enters the combustion chamber, resulting in a saving of fuel.

Summing up; the turbine is basically built up from a compressor, a turbine to drive it, and a separate power turbine with a heat exchanger and combustion chamber to raise the temperature of the air which helps to save fuel.

So remember, if you hear a whistling noise on tomorrow's roads that it is no ordinary vehicle that will be making the sound but one of Britain's very latest invetions.

Unusual in a rather different way is the very latest use for diamond cutters. Not, as you might think for cutting metal or glass, but to help speed up the construction of boats.

A Norfolk boat-building firm have found that by introducing diamond cutters for trimming glass-fibre reinforced plastic hulls, it can cut the time of construction by as much as 40 per cent. The boats concerned are 39 ft. by 12 ft. luxury river cruisers, designed for the Norfolk Broads, and each consists of a complete superstructure, deck and cabin, bonded to the hull for strength. All the structural components are glass-fibre, which was chosen for its toughness and ease of maintenance and repair.

Experience has shown that diamond cutting discs eliminate the incredible amount of dust caused with conventional tools, and also give a far better finish in a much shorter time—6 days for a completed hull against 10 previously.

Called the "Caribbean", the new type of cruiser has only been in production for eighteen months and the makers are planning to export the model and are also designing a 45 ft. high speed cruiser suitable for the American market.

Finally, we heard recently that the Southern Region of British Rail have decided to run their crack express, the "Brighton Belle" in a new livery. Gone is the familiar Pullman chocolate and cream colours, and in their place is a new blue and grey livery, in keeping with the expresses running on the London, Midland main line. On each coach of this famous express however will bear the legend "Brighton Belle" in white letters, and this will also appear at the front and rear of the unit on the yellow driving cabs.

Inside, the train has been completely renovated and the upholstery in the second class coaches is now in an attractive blue and green check with navy blue arm and head rests. First class compartments have been upholstered in charcoal and grey check and all coaches will not be fitted with mustard coloured carpets.

The other "Brighton Belle" units will still be seen in chocolate and cream and it is planned to deal with them similarly during the coming months. Two units are used to form each train so, for a short while, the unit in the new livery will be running with another unit still in the old livery.

Work on another improvement on the Brighton line is already taking place, and all the old station names and directional signs at twenty-one stations on the line are being replaced by new and bigger "read at a glance" modern signs with black lettering on a white background.

The exterior of the new Brighton Belle unit shows off its very clean and modern lines. The interior has also been completely renovated. The new livery is in blue and grey in keeping with the other expresses running on the L.M.R. line.

BATTLE

Part XI—Armoured Action

by Charles Grant

THE FIRST " active service " we take part in, will of necessity be a fairly simple sort of thing, involving only a few armoured fighting vehicles on each side—a straightforward sort of terrain (you can see what it is like from the diagrams and photographs). The idea is to provide a first illustration of how we go about the business of fighting on the battlegame table. The latter, by the way, for the purposes in mind, is not enormous, and measures 7 ft. by 4½ ft. (or half the size of that which we shall use later on). The ground will be seen to be pretty flat, *figure* 1 (the small hills are reckoned to be steep and unclimbable) and its main features are a river, crossed by two bridges, 'A' and 'B', a few small woods, some walls and a couple of ruined cottages. Then there are the roads, of course, which, it goes without saying, are very important. The tactical scheme is similarly without complication—'RED', coming from the east, and 'BLACK' from the west, each has orders to advance and secure the river crossings, the background being that the task forces involved are advanced guards of much larger armies.

As to what we shall actually engage, then, 'RED' has four Russian T.34 tanks—equipped with the 85 mm. gun—while 'BLACK' has four German Mark IV tanks—the variant with the 'long' 75 mm. gun—and two heavy armoured cars, armed with 50 mm. guns.

Just to recapitulate, the technical data relevant to all these is assembled for ease of reference in the Table (Note that the speeds of the Mark IV are additional to what was given in Part III of " Battle "). I include it as much for my own benefit as the reader's—it is designed to save a lot of checking through former articles—as, at the time of writing, the action has indeed yet to be fought. I don't know how it is going to go any more than anyone else. Before we start, though, a quick word about the sequence of events. In a 'game move' each player moves his pieces—tanks, etc.—the distance allowed by the rules (or less, of course), and at the end of the 'moving' his guns will fire, again if he desires, and naturally, only if he has a target within range. Damage is assessed, and that is the end of the 'game move', which consists of a combination of movement and fire. In the present case, we assume that the contending forces are just off the table, and will appear thereon on the first move.

Having thrown dice to establish visibility, and happily having found that it is maximum—that is to say, 30 in. and 45 in. for unaided and aided respectively—we can proceed to dispense with the former, all vehicle commanders doubtless being well supplied with binoculars and so on.

With the task forces ready to come on to the table by their various roads and being in column with, say, a couple of inches between each vehicle, the first in line will be able to make its maximum move from the edge of the table, the others following up as appropriate. So, off we go.

Coming from the west, BLACK, of course, headed his column with the two fast armoured cars, and with an eye to what he considered his own advantage, sent them along the left hand fork—the North Road—while his Mark IV tanks remained in column on the South Road, moving their full 12 in. RED, on the other hand, decided to deploy forthwith, his leading tank sticking to the road, but moving only 6 in., to allow the others to come up as far as possible into a line-abreast formation, two on the right and one on the left of the leader. Nothing was as yet in visibility, but we are getting warm !

On the second game move, BLACK's cars did another 24 in. move along the North Road, while his tanks trundled on in column, the head of which came up to the nearer of the two ruined cottages. RED's No. 3 tank accelerated, doing its full 15 in. road move and outdistancing the others, who were limited to the 8 in. cross country move. With all these moves completed, the situation was as shown in *figure* 2. First to note enemy activity were the armoured cars, but their radio message to their tanks was unnecessary, as the leading Mark IV had already seen the RED force, and vice versa, (they were just inside the 45 in. visibility). Both sides opened fire, this being a simultaneous operation, naturally, and this is still the second move we are working on, of course.

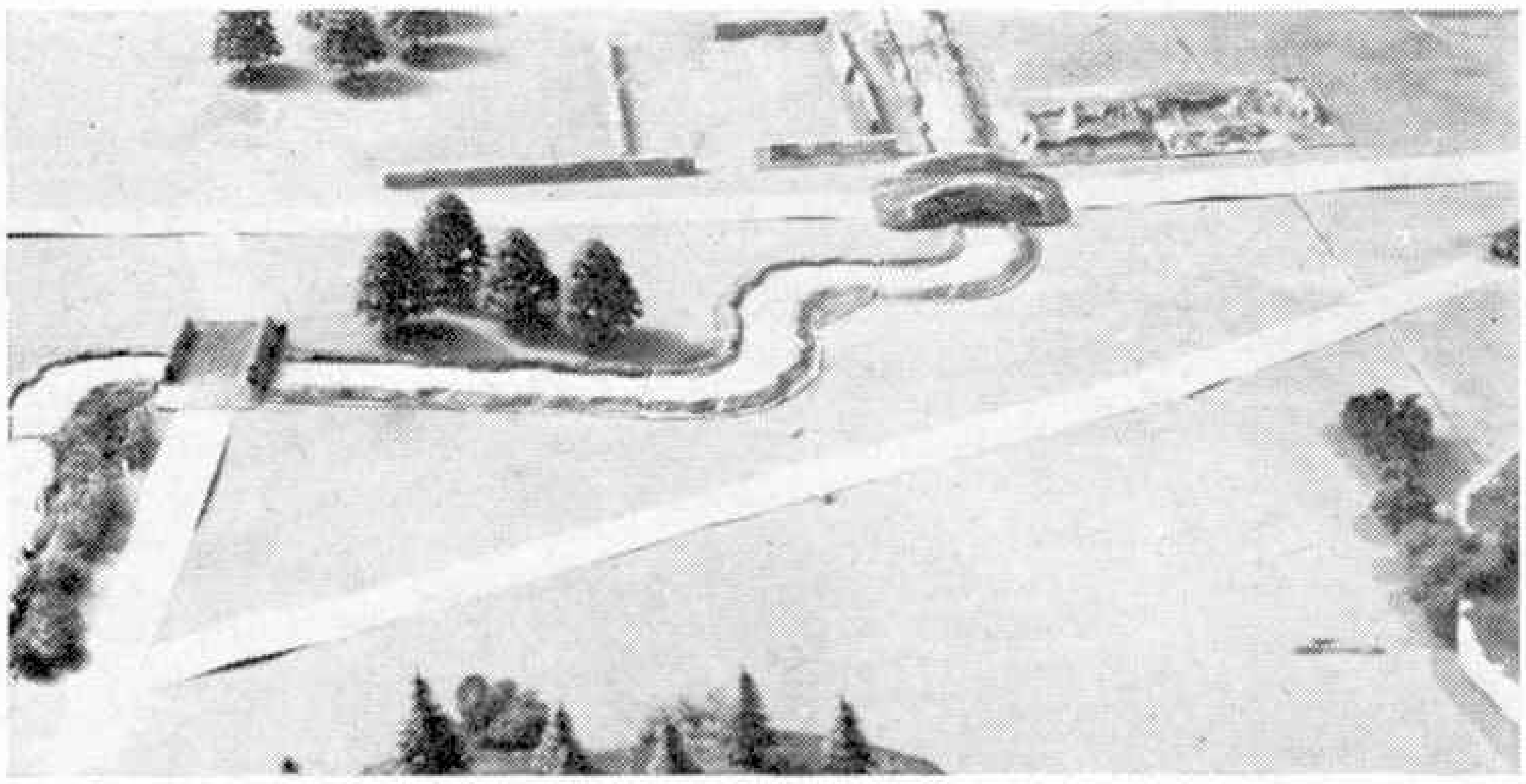
Let us take RED first, then. The range of the leading armoured car from T.34/No. 3 is just within the 20 in.-30 in. section—so to score a hit requires a throw of 8 or more with two dice. RED throws, gets only 5—no hit. T.34/No. 2 fires at the same target—range this time 30 in.-45 in.—9 is required for a hit, and 10 is thrown ! A hit, a palpable hit, no less. The Tank Stick (see its description in Part X) shows the strike angle of 'minus 1', reducing RED's Strike Value from 6 to 5. He throws 9, which with the 5 makes 14, and as the armoured car's Defence Value is only 12, it is therefore well and truly 'kaput' and out of action. First blood to Red !

(NOTE—I have said 'out of action' deliberately, because later on we shall see that this can be a matter of degree, or even time, the time being that occupied by the crew in getting the vehicle back into service, if, of course, this is possible).

Now for BLACK's armoured car; the nearest T.34

REFERENCE TABLE

Vehicle	Speed		Gun	Maximum Range	Strike Value				Defence Value
	Road	X-country			0″-10″	10″-20″	20″-30″	30″-45″	
T.34/85	15″	8″	85 mm.	60″	11	9	8	6	14
Mk. IV	12″	6″	75 mm. (long)	45″	7	6	5	4	14
Armoured Car	24″	6″	50 mm.	30″	5	4	3	—	12



The " Battlefield " from the north, river sections, bridges, walls are by Bellona, trees by Merit.

is just within maximum range of its 50 mm. gun—30 in.—and 8 is required to register a hit, but, in fact, only 5 is thrown—not enough.

Continuing with the firing, we see that the leading Mk. IV is in 30 in.-45 in. range of T.34/No. 3, but RED fails in throwing for a hit, scoring only 4. The Mark IV now replies, and gets a hit with a throw of 10. Its shot is plumb against the front of the enemy tank, and the T.34's Defence Value, with ' frontal ' bonus of 1 is, of course, 15. At the range in question, the ' long ' 75 mm. has a Strike Value of only 4, and, so requiring a dice throw of 12 for a ' kill ', we are not unduly surprised when only 8 is thrown. (Mutterings at this point from General ' BLACK ').

So, at the end of Move 2, BLACK has lost an armoured car, RED has not suffered, and on we go with the third game move.

All RED's tanks advanced roughly in line abreast—an 8 in. move—and two of BLACK'S Mark IV's moved off the road to the south, one into the ruins and one to a position near Bridge ' A '. The two others veered off northwards—6 in. cross country move. The surviving armoured car turned back to seek shelter behind some trees, and the end-of-move position is as in *figure* 3.

Again the firing, beginning with BLACK, whose armoured car had a ' go ' at T.34/No. 1, on the right of RED's line, the range being 20 in.-30 in. The throw of 7 was insufficient to score a hit. Three Mark IV's were now able to fire, and the one ensconced in the ruined cottages scored 6 in attempting to hit T.34/No. 4 at 30 in.-45 in. range—no hit. The next, beside Bridge ' A ', singled out the RED tank on the road, at the same range. It registered a hit on the front of the enemy, but the throw for effect was not enough against the Defence Value of 14 plus 1. The third Mark IV also failed to score. All this being pretty frustrating for BLACK.

Now for RED. The two right hand T.34's—Nos. 1 and 2—both fired at the armoured car, at 20 in.-30 in. range, but neither scored a hit—most fortunate for this very vulnerable vehicle. The other T.34's fired at the BLACK tanks southwest of Bridge ' A ' and again, much to RED's digust, neither made the 8 necessary for a hit at the applicable range.

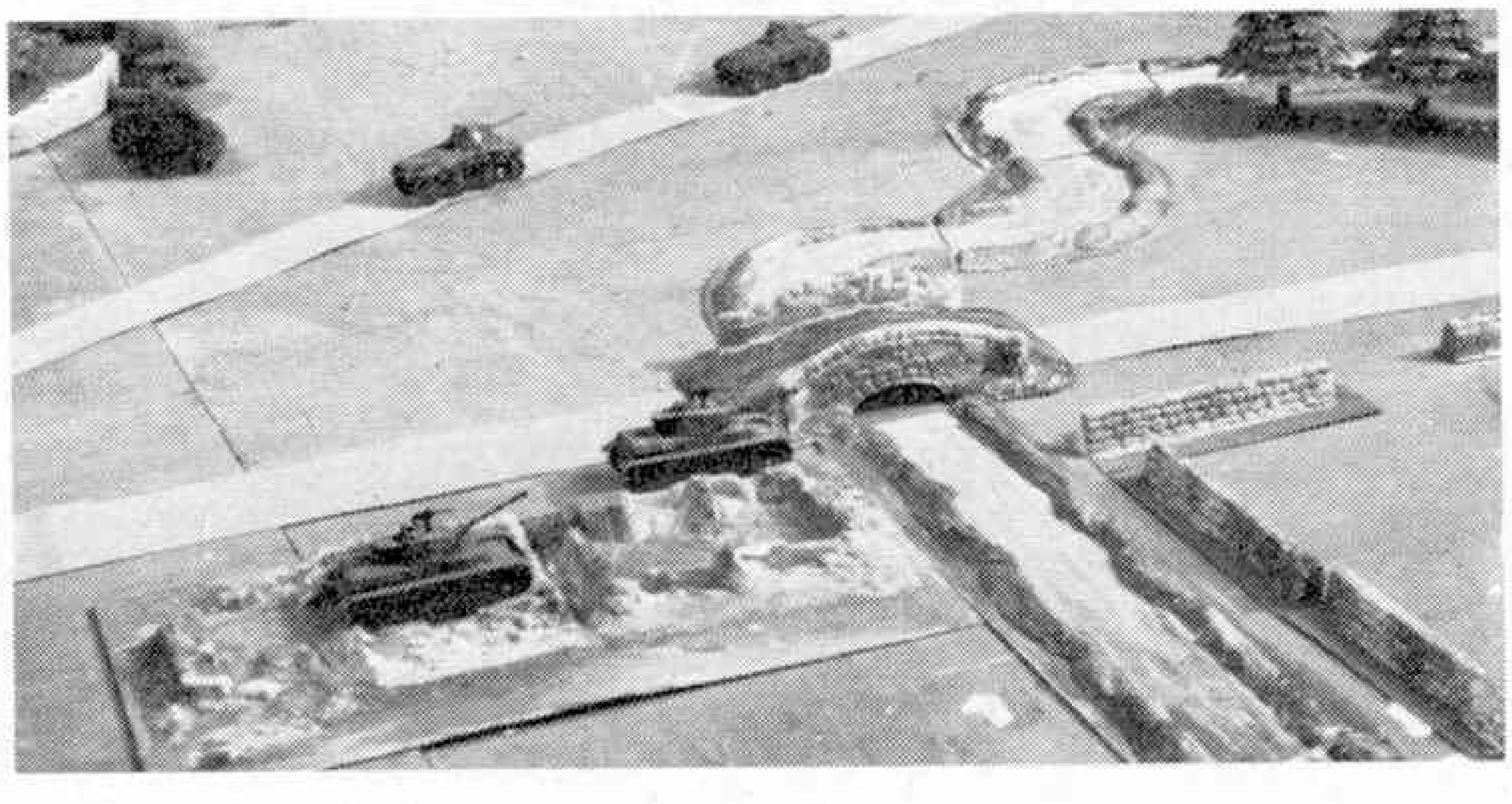
On we go with the fourth move, then.

All RED's tanks eased forward somewhat, and BLACK also advanced. Mark IV/No. 2 moved from the ruins towards the river, No. 1 from the south side of the road, to the north, just west of Bridge ' A ', No. 3 due east, and No. 4 back onto North Road. (*Figure* 5.)

Now the firing: RED's No. 1 tank had a go at the side of BLACK's armoured car and, throwing a 9, scored a hit (20 in.-30 in. range). With no angle deduction, he then threw a tremendous 11, giving, with the Strike Value of 8, a total of 19. No doubt about this—BLACK's second armoured car was no longer fit to take any further interest in the proceedings. The other three RED tanks concentrated their fire on the Mark IV by the bridge, but only one scored a hit, and its subsequent throw for effect was only 4, which was not enough to have any effect on the target's frontal armour. Three Mark IV's replied, all registering hits, but not one of the effect throws was enough, although one was pretty much a ' near miss '.

And still no RED casualties !

On Move Five, RED T.34/No. 1 crossed Bridge ' B ' and positioned itself on the north side thereof



Two " BLACK " tanks take up firing position while the armoured cars race off up the North Road. (All vehicles are Minitanks.)

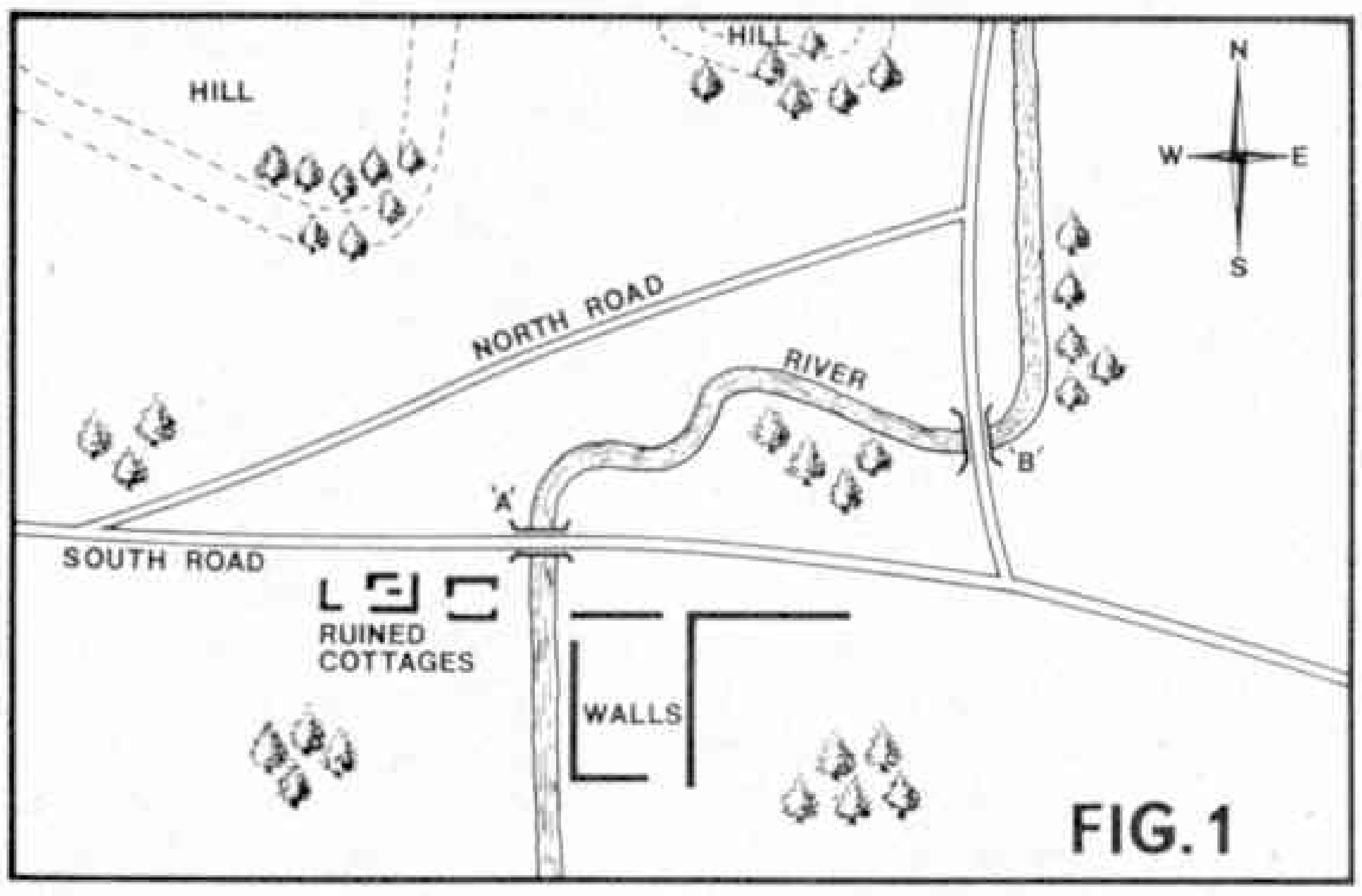


FIG. 1

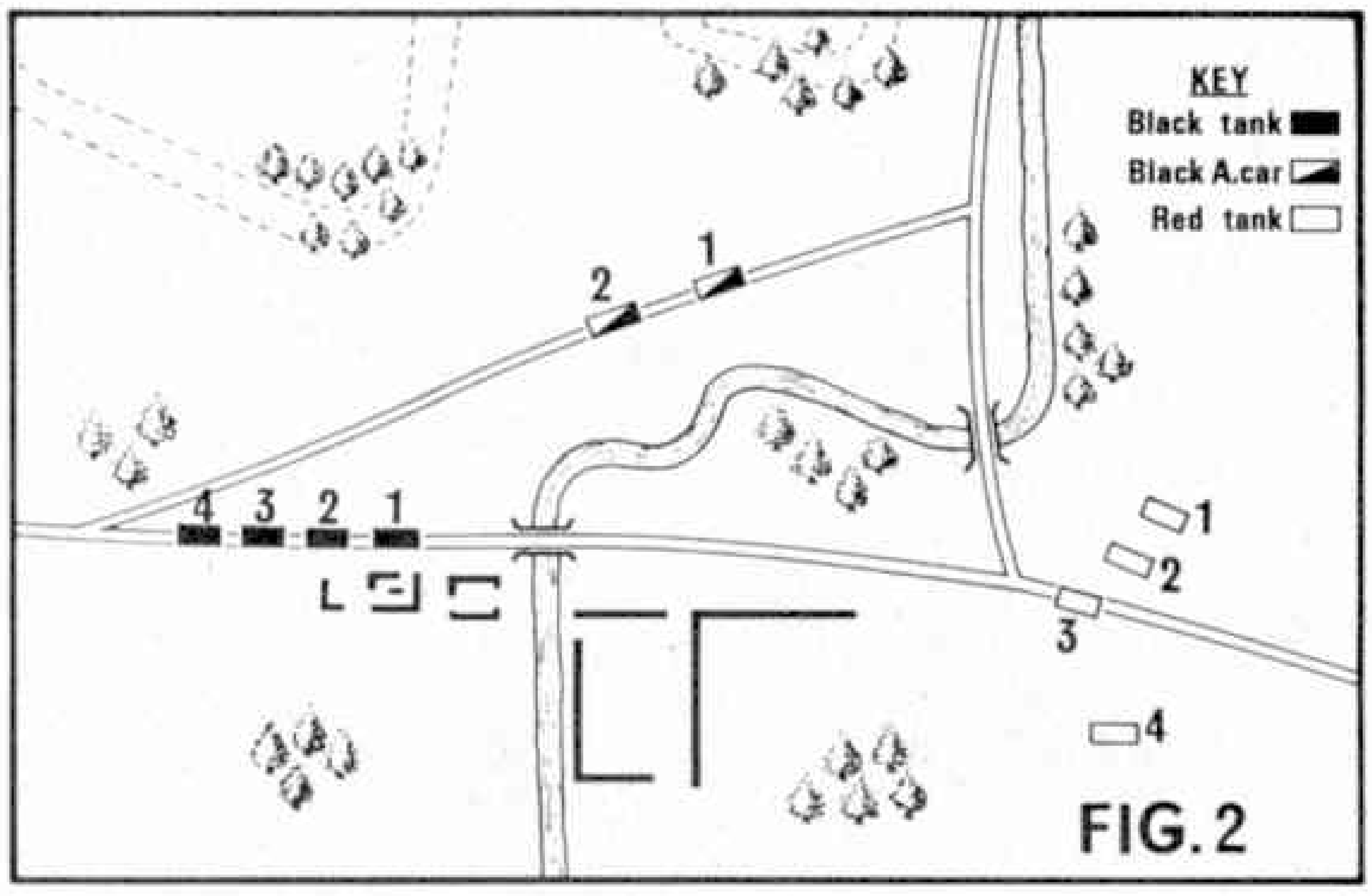


FIG. 2

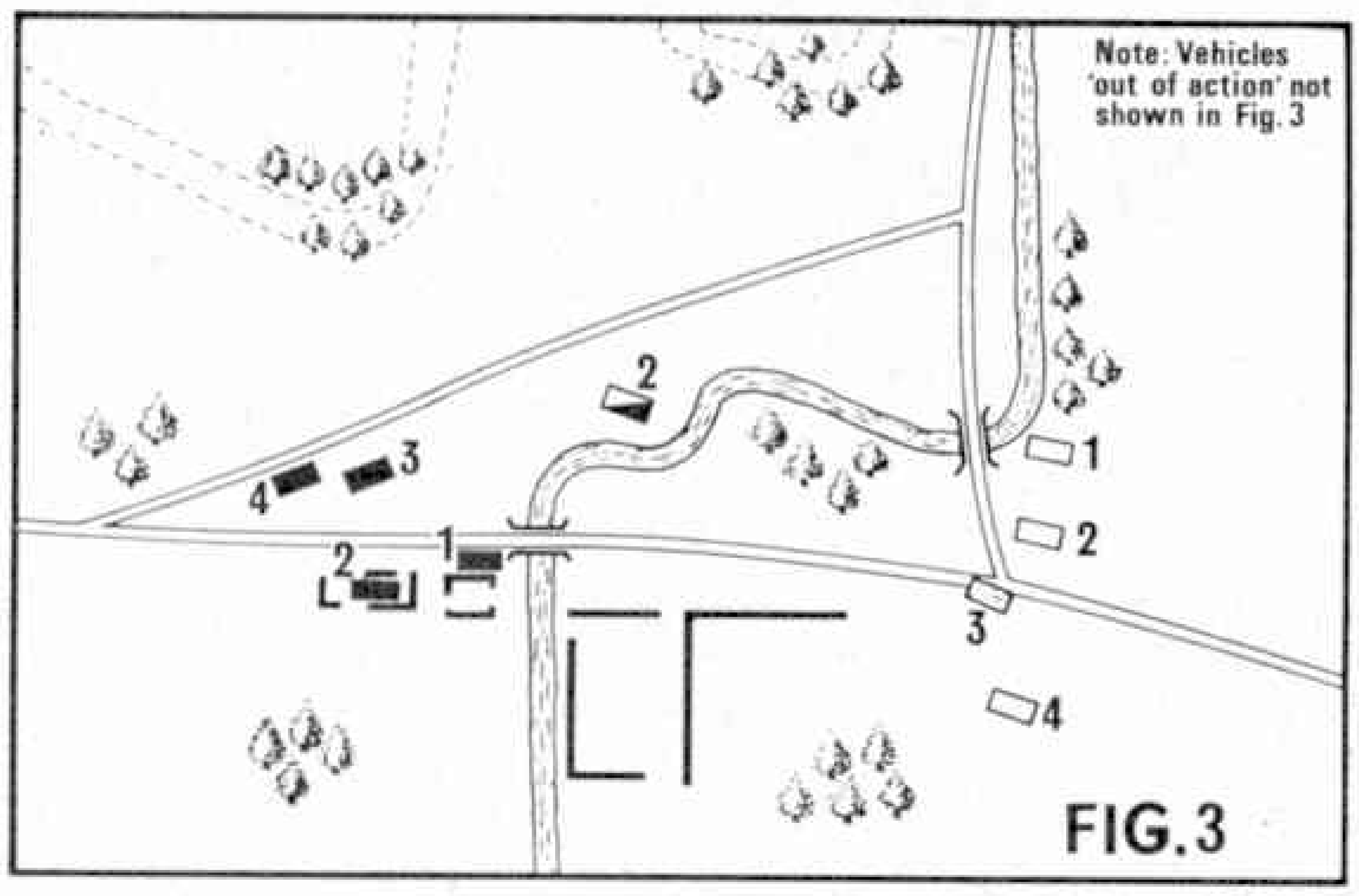
facing west, while No. 2 came up to the south end of the same bridge. Nos. 3 and 4 advanced 8 in. BLACK moved his No. 4 tank eastwards on North Road—a 12 in. move—his idea being to threaten RED's right flank, while his other three remained pretty much in the same positions. (*Figure* 5.)

The firing, then: with BLACK beginning. Mark IV/No. 4 fired at the T.34 at the north end of Bridge 'B', scored a hit, but the effect throw was pair of '1's'. BLACK's No. 2 then had a crack at T.34/No. 4, and at 10 in.-20 in. range scored a hit, but had the horribly bad luck, on throwing for effect, to get two 1's again. Both No. 1 and No. 3 Mark IV's also scored hits, but failed with their effect throws. Hard luck on BLACK.

Now for RED: Tank No. 1 fired at the Mark IV on the North Road, and scored a hit. Defence Value in this case 14 plus 1 frontal bonus, but the effect throw of 9 was enough with the S.V. of the same to put the target out of action—the Mark IV 'brewed up'. T.34/No. 2 failed to score a hit on its target, but No. 3 at 10 in.-20 in. against No. 3 Mark IV, hit it, and then threw 7 for effect, giving a Strike Value of 16, and yet another BLACK tank went up in smoke. Finally, the last T.34 failed to hit its target, and that's the end of the move.

And one might say, there it is. What's to be done? In the circumstances, having suffered so heavily, BLACK would be wise to pull out, if he can, and fall back towards his main body. Reinforcements could be brought up, of course, and it might be hoped that they would include heavier metal to take on the formidable T.34's. In retrospect, it might have been fairer to have had the 76 mm. gun variant for the T.34 rather than the one equipped with the 85 mm. One can imagine the dismay of the Germans in Russia when for the first time they came up against such a powerful weapon as the T.34. No wonder that the process of bringing out the "Panther" had such priority.

Anyhow, we have had our first "Battle," albeit a quick and simple one, and it must be obvious that it was only a warmup for bigger engagements. There would be no harm in carrying on from where we left off, and if the reader wishes he can organise reinforcements and continue the conflict. If any should do so, I should be glad to hear what happens. Later on I hope to set the occasional Tactical Problem with a given map and forces, together with specific objectives, but of this, more later. Meantime, now that we have begun to familiarise ourselves with land warfare, we shall get back to the "Queen of Battles"—the infantry—and add a few more interesting factors to "Battle".



Note: Vehicles 'out of action' not shown in Fig. 3

FIG. 3

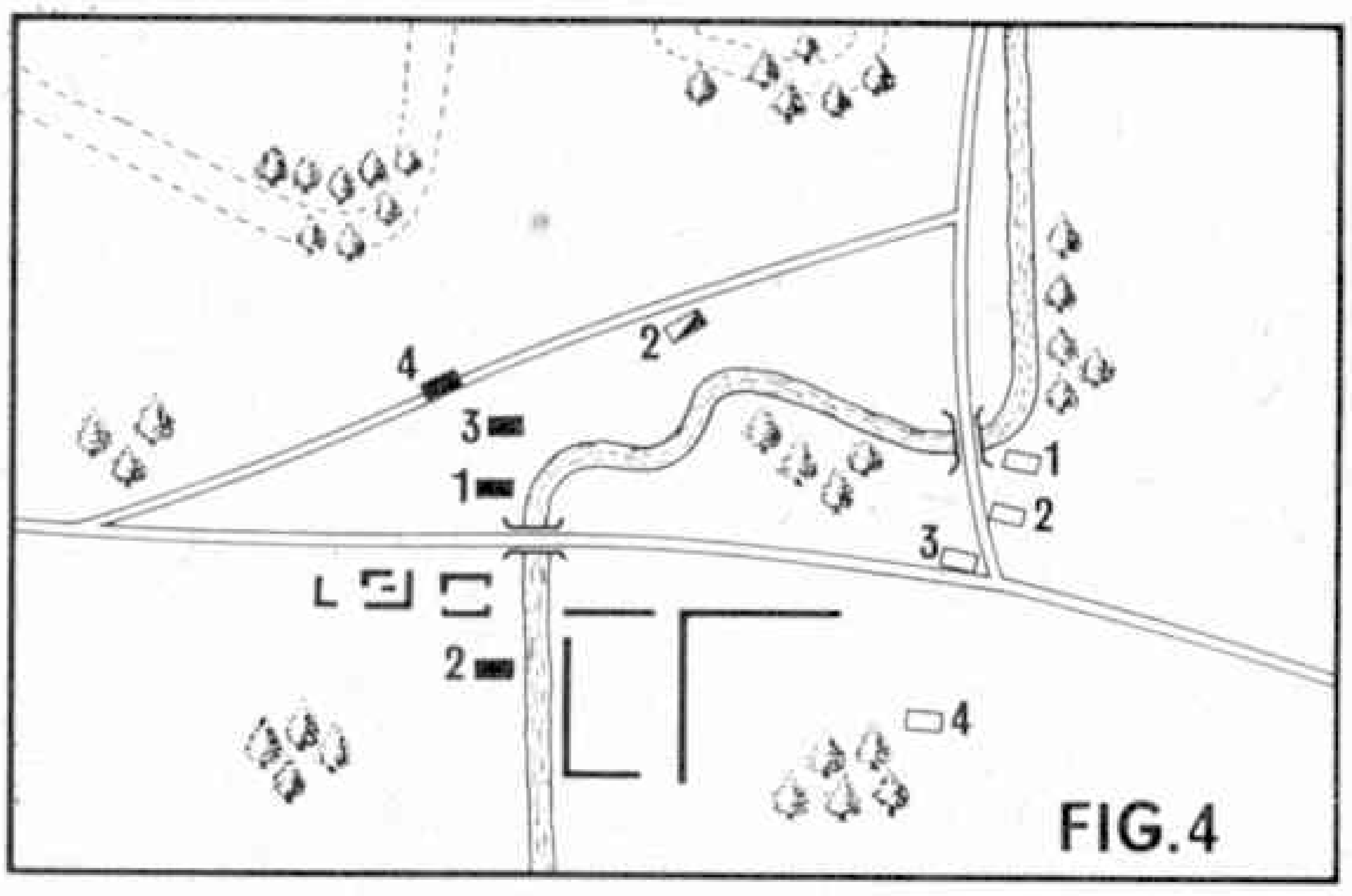


FIG. 4

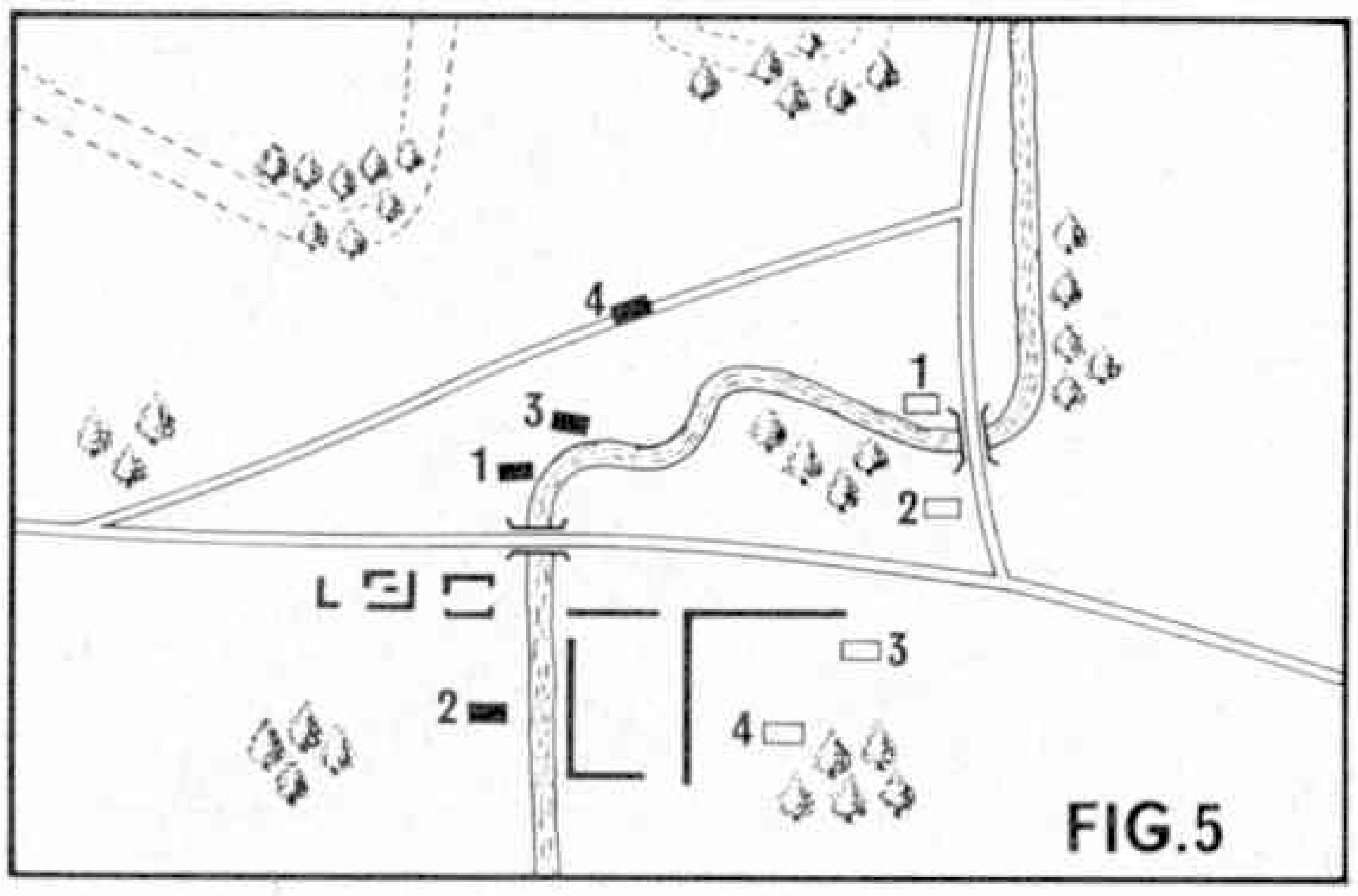
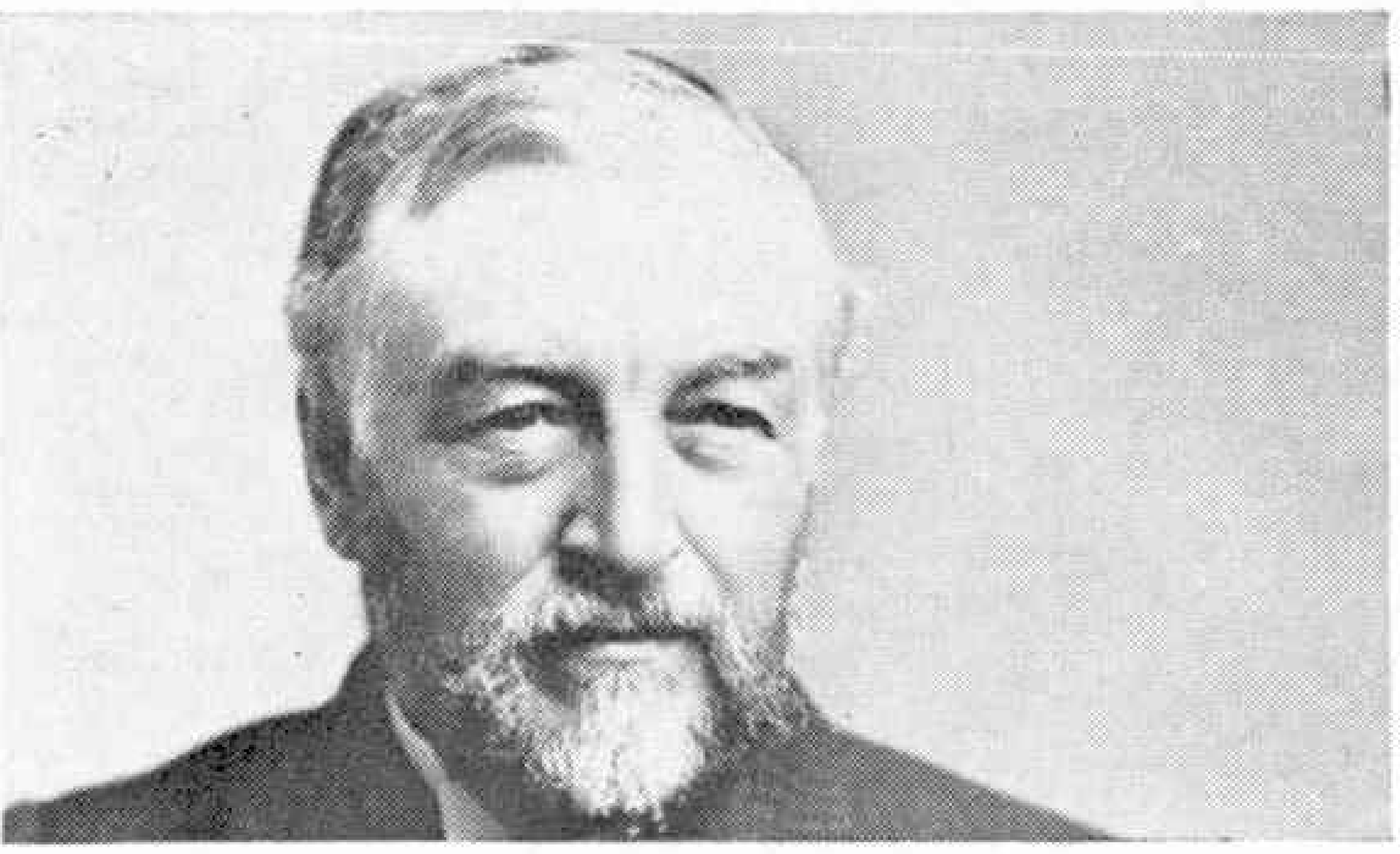


FIG. 5



THE FORGOTTEN PIONEER OF AVIATION

by E. R. Yarham

THE SMITHSONIAN Institution at Washington—the most famous foundation of learning in the American continent—possesses a unique series of models constructed by a brilliant scientist, who by ill luck was robbed of the honour of having built the first power-driven, heavier-than-air machine capable of flying with a man. Yet he died without knowing of his success.

Although Samuel Pierpoint Langley is known to few, he stands high on the list of pioneers who brought nearer the epoch-making day when the Wright brothers made the first flights in a heavier-than-air machine. In his own estimation, however, Langley counted for little. "My life's work is a failure"—such were his words at the age of 70 when his efforts to launch into the air a man-carrying "aerodrome" (as he termed it) met with failure, and were accompanied by a chorus of ridicule and attack from an unsympathetic press.

Later it was discovered that the failure was merely due to wrong methods of launching; and eight years after his death this notable pioneer's name was triumphantly vindicated. The same machine that had failed to move from an unsuitable launching platform, rose from water as if instinct with life, and as if aware that the air was its real element. It flew perfectly.

This was in 1914, when Glen Curtiss, one of the best-known of America's pioneer pilots, was given permission to take the machine from the Smithsonian Institution and to try it out. Using exactly the same engine and propellers, the only radical difference being the fitting of floats to enable it to take off from the water, the pilot tested it on Lake Keuka, New York State.

At the first attempt the machine rose and flew for 150 feet with absolute grace and stability, and demonstrated its wonderful ease of control. When it is remembered that the Wrights' first flight lasted only twelve seconds, the significance of Langley's achievement can be appreciated. Later the machine was fitted with an 80 h.p. engine and further flights were made.

Furthermore, although Langley's launching experiments failed, the method he used became a valuable means of getting a plane into the air. For Langley employed a primitive form of catapult, which years later was used on battleships. Once again Langley's idea was right; and it is one of the strangest facts of aeronautical history that the name of this scientist, one of the most brilliant and able of aviation's early researchers, and whose work greatly influenced the Wright brothers, is so little known. Some histories of the subject hardly mention Langley.

Yet he was sufficiently well known when carrying out his early experiments in flight. As a matter of fact the names of Langley and the Wright brothers were linked in one of the great national-science disagreements of the past century. Nobody believed the Wrights' earliest flights were true, and for some years the brothers did not even bother to convince the world.

When they did they found the Smithsonian Institution sceptical and backing up Langley's experiments instead. It was because of this that they put their historic plane, "Kitty Hawk," in which they had made their first flights at Kitty Hawk, North Carolina, on exhibition at the Science Museum, South Kensington, instead of the United States.

Although the Wrights were the first men to fly, and Langley was robbed by cruel mischance of proving himself to have been the first human being to have built a heavier-than-air machine capable of flying with a man, the debt science and aviation owe to him is a large one. Langley was born at Roxbury, Massachusetts, on August 22, 1834, and his life demonstrated that he was a genius of many parts. His published works, covering an amazing range of topics, include nearly 200 titles.

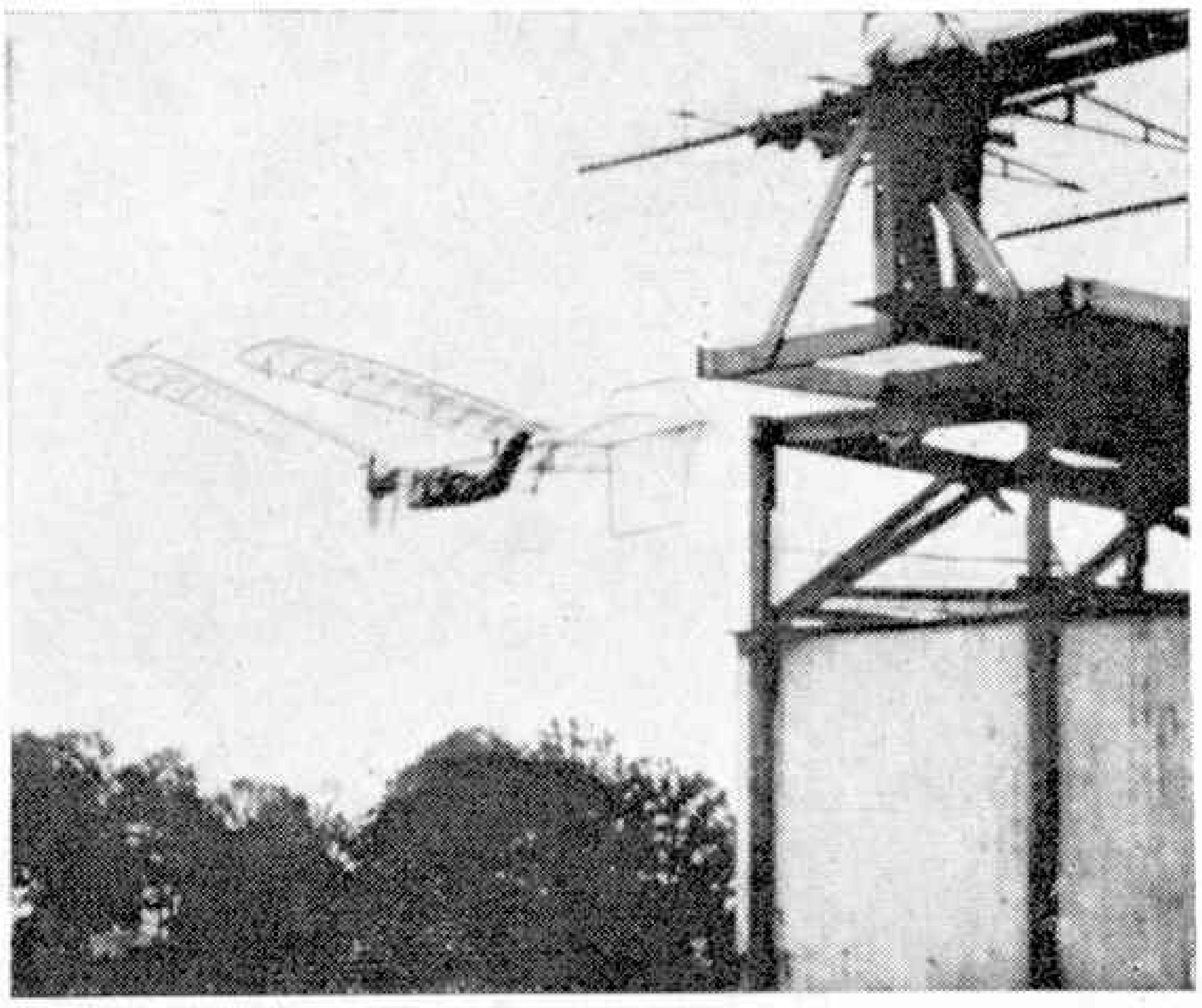
Langley was an authority on architecture, civil engineering, physics and astronomy, to mention only a few of his acquirements. He conducted researches into the solar spectrum, and in order to achieve hitherto unattained accuracy he invented what is known as a bolometer. It is still one of the most remarkable instruments known to science, and the improved models on that of Langley, and the most accurate types, are capable of recording a change in temperature so inconceivably small as one-hundred millionth of a degree.

Thus the brain Langley brought to the study of the possibility of mechanical flight was an acute one. All his work evidences meticulous care and accuracy, and it was typical of him that he determined to commence with fundamentals, scrapping the old-time theories which then held the field, professing to explain how birds flew.

He carried out a long series of experiments with a stuffed frigate bird, a Californian condor and an albatross, using a huge "whirling table" for this purpose. Next, he substituted for the birds, mechanically propelled arms, and made minute calculations of the lift and resistence met with. Langley's conclusion was—in his own words—that "it was possible to construct machines that would give such velocity to inclined surfaces that bodies definitely heavier than air could be sustained upon it and moved through it with great velocity." This came true—literally word for word.

Langley also made an exhaustive study of the winds, and then, having accumulated what he considered sufficient data, he determined to test out his theories. He started building models in 1892, but it was not until four years later that there occurred what has been termed "the most dramatic moment in the history of human flight."

This was on May 6, when he successfully launched Model No. 5 over the Potomac River (Washington), and it sustained itself in the air on two occasions for one and a half minutes. The model was accurately constructed in every detail, and was a smaller version of the man-carrying "aerodrome" he was planning to



One of Langley's steam powered models being flown over the Potomac river in the U.S.A. This was catapult launched from the top of a boathouse.

build. The machine was fitted with a steam-engine developing one and a half h.p.

Langley took his machine down to a house-boat moored on the Potomac, and the great moment came when it was catapulted from a stage on the top. It rose from the boat, sailing gracefully into the air, and continued flying for the full time for which it was supplied with fuel and water, approximately one and a half minutes. When the fuel was exhausted it descended gently into the waters of the river, quite undamaged. For the second time its builder launched it, and once again it flew perfectly. On both occasions the machine covered between a half and two-thirds of a mile.

Undoubtedly the scene on the Potomac river that day was one of the most momentous in the history of communications. Langley, at any rate, realised its significance, and he was so excited by his achievement that he had to withdraw into the woods to hide his emotion. Knowing this we can better understand the bitterness of the defeat that overwhelmed him a few years later.

The significance of the inventor's accomplishment has been summed up in one account of his life in these words: "Never in the history of the world, previous to these attempts, had any mechanism, however actuated, sustained itself in the air for more than a few seconds. He thus paved the way for others who have achieved success with man-carrying machines." The only other man who had ever come near to success was Stringfellow, who died in 1883. He had succeeded in getting a model plane to fly the length of a disused factory, powered by steam, but slung on a wire.

Dr. Graham Bell, the Scotsman famed as the inventor of the telephone, and who also worked with the Wright brothers, was a witness of some of Langley's experiments, and this is how he describes the flight of one model: "The machine, at a given signal, started from a platform about 20 feet above the water, and rose at first directly in face of the wind, moving at all times with remarkable steadiness, and subsequently swinging around in large curves of, perhaps, 100 yards in diameter, and continually ascending until its steam was exhausted, when, at a lapse of about a minute and a half, and at a height which I judged to be between 80 and 100 feet in the air, the wheels ceased turning, and the machine, deprived of the aid of its propellers, to my surprise did not fall, but settled down so softly and gently that it touched the water without the least shock, and was, in fact, immediately ready for another trial."

In November of the same year Langley made a further advance when another of his models achieved a speed of 30 m.p.h., and flew three-quarters of a mile. The inventor did not press on with the building of a full-scale machine immediately, for as a scientist he was not so much interested in providing a method of transport as in proving the practicability of mechanical flight.

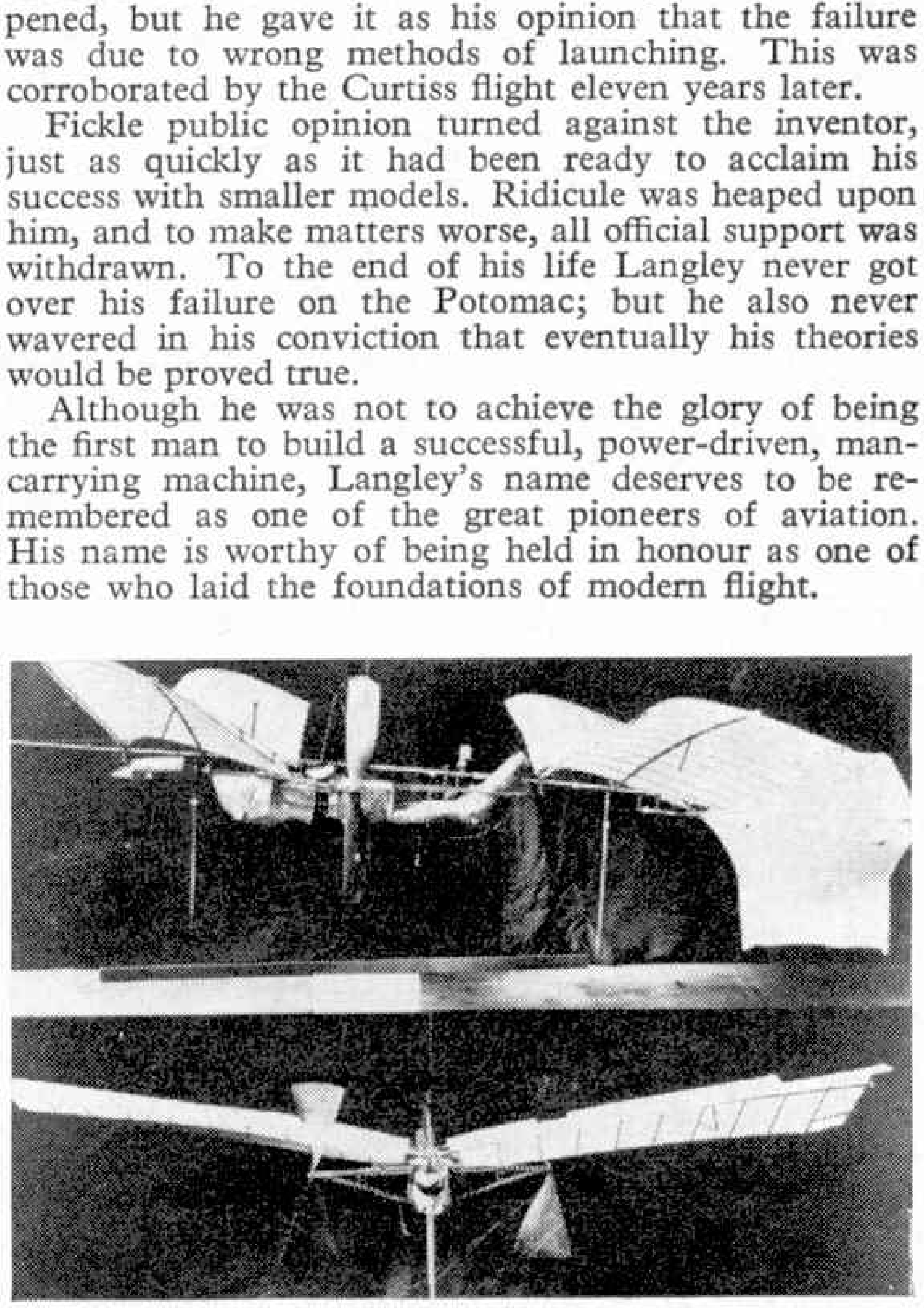
It was the American Government which induced him to take up his work afresh, and funds were provided so that he could experiment with the building of a man-carrying machine. This was ready in the autumn of 1903, the work having extended over five years. The machine was fitted with an engine built by a clever young mechanic named Manley, who was also chosen to act as pilot.

A representative of the American War Department, Major Macomb, watched the trials. These took place in October and on December 8 (Orville Wright's first momentous ascent was on December 17). On both occasions the engine started up perfectly, and both propellers whirled rapidly. Everything looked auspicious for success but, as recounted earlier, the launching apparatus proved faulty.

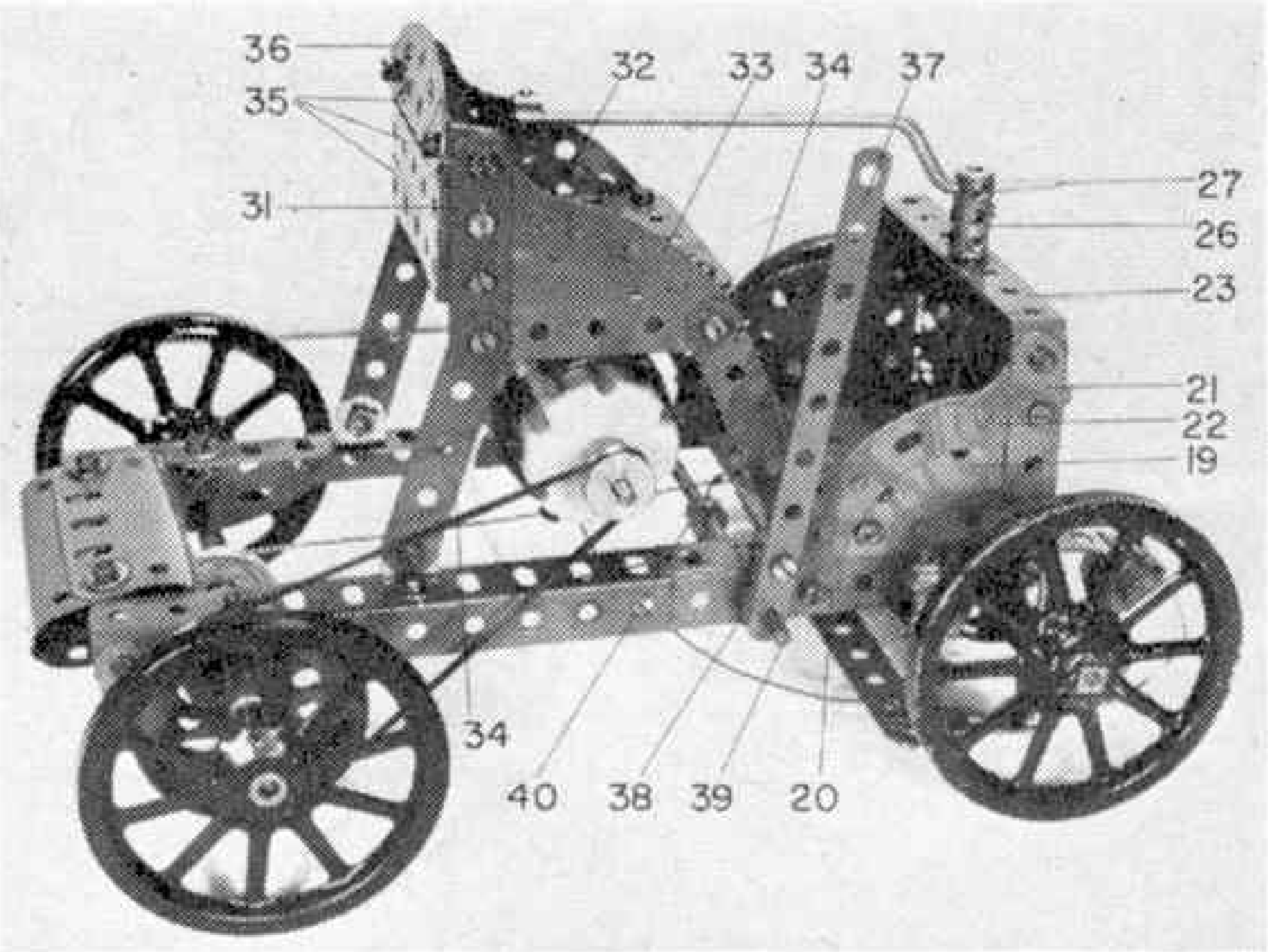
At the first attempt the nose of the machine dropped downwards and it plunged into the water. It was salvaged and repaired, but again, at the second attempt, the machine was wrecked at the take-off. The official observer said that he could not exactly see what happened, but he gave it as his opinion that the failure was due to wrong methods of launching. This was corroborated by the Curtiss flight eleven years later.

Fickle public opinion turned against the inventor, just as quickly as it had been ready to acclaim his success with smaller models. Ridicule was heaped upon him, and to make matters worse, all official support was withdrawn. To the end of his life Langley never got over his failure on the Potomac; but he also never wavered in his conviction that eventually his theories would be proved true.

Although he was not to achieve the glory of being the first man to build a successful, power-driven, man-carrying machine, Langley's name deserves to be remembered as one of the great pioneers of aviation. His name is worthy of being held in honour as one of those who laid the foundations of modern flight.



These side and front elevations of Langley's first steam driven "Aerodrome" give one some idea of its complexity.



The First and the Famous

by Spanner

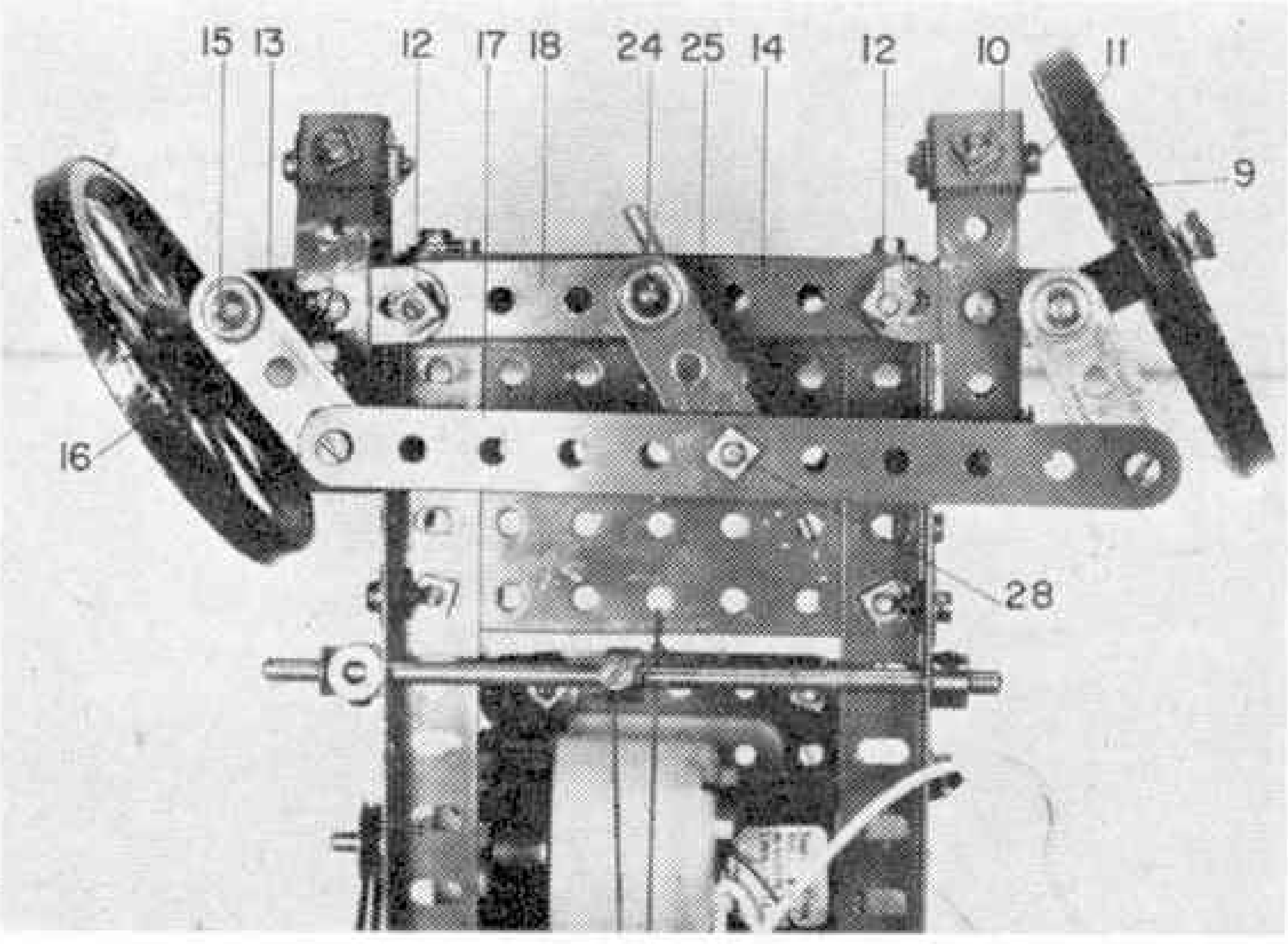
Two of Henry Ford's historic cars reproduced in standard Meccano

HENRY FORD is perhaps the most famous name in the history of the motor car. It was Henry Ford who originated the production line system for motor car manufacture and it was Henry Ford who, from starting with practically nothing, built up the colossal Ford Motor Company into one of the largest automobile manufacturers in the entire world.

The Ford Motor Company was officially incorporated in 1903, but it was some years earlier, in 1898, that Ford, himself, built his first "horseless carriage". This was a weird-looking affair, spindly in appearance and with handle steering: far removed from the later vehicle which really made him famous—the Model T, known affectionately by all as "Tin Lizzy". Our model-builder, ever on the look-out for ideas, came across some illustrations of the two cars in a reference book and was immediately struck by the tremendous difference between the "first Ford and the famous Ford". It was not long, therefore, before I received the two models featured here and, although they are both only simple approximate reproductions, I think you will agree that they admirably illustrate the design differences between the two.

Ford's first car

Following the course of history, we will begin with the 1898 creation which, as you can see, is not at all difficult to build. The chassis consists of two 8½ in. compound angle girders 1, each consisting of a 7½ in. and a 1½ in. Angle Girder, connected together, at the front, by a 3½ in. Angle Girder overlayed by a 3½ × 2½ in. Flanged Plate 2 and, at the rear, by a 3½ × ½ in. Double Angle Strip 3. Bolted to this Double Angle Strip are two U-section Curved Plates 4 serving as the petrol tank. Two 2½ in. Stepped Curved Strips 5 are next bolted one to each Angle Girder 1 to provide bearings for a 6½ in. Axle Rod 6 carrying a 1 in. fixed Pulley 7 and held in place by a Collar and a 2 in. Pulley 8. A 3 in. Spoke Wheel is mounted on each end of the Rod.



Turning to the opposite end of the chassis, two springs are each produced from a 2½ in. Strip 9 to each end of which a Double Bracket 10 is bolted. A further two Double Brackets are bolted to a second 2½ in. Strip then the two Strips are curved and attached to each other at one end by a ¾ in. Bolt 11 passed through the lugs of the Double Brackets and, at the other end, by a 1⅛ in. Bolt passed through the lugs of the Double Brackets and lock-nutted through the third hole in the vertical flange of compound girder 1.

Two ¾ in. Bolts 12 are next fixed in the end holes in the horizontal flanges of the chassis members, are fitted with Compression Springs and are then used to secure two Cranks 13 one to each end of a 3½ in. Strip 14. The Cranks are in turn bolted to Strips 9, as shown. Note that the bosses of the Cranks point downwards. Loose in the boss of each Crank is a 1½ in. Rod 15, on the lower end of which another Crank 16 is fixed. A Washer is mounted on the Rod above Crank 13, to be followed by a Collar, in the threaded bore of which a 1 in. Screwed Rod is fixed, then a 5½ in. Strip 17 is lock-nutted between the arms of Cranks 16.

Bolted to the 3½ in. Angle Girder at the front of the chassis which, incidentally, is numbered 18 in the illustrations, is a 3½ × 2½ in. Flexible Plate, then a 2½ × 1½ in. Triangular Flexible Plate 19 is secured to each flange of Flanged Plate 2. A 2½ in. Stepped Curved Strip 20 and a 2½ in. Strip 21 are bolted as shown to angle girder 1, one of the securing Bolts also fixing a 1 in. Corner Bracket 22 in place. Bolted between Strips 21 at each side is a 3½ × ½ in. Double Angle Strip 23. Journalled in the centre hole of this Double Angle Strip and in 3½ in. Strip 14 as well as in

PARTS REQUIRED

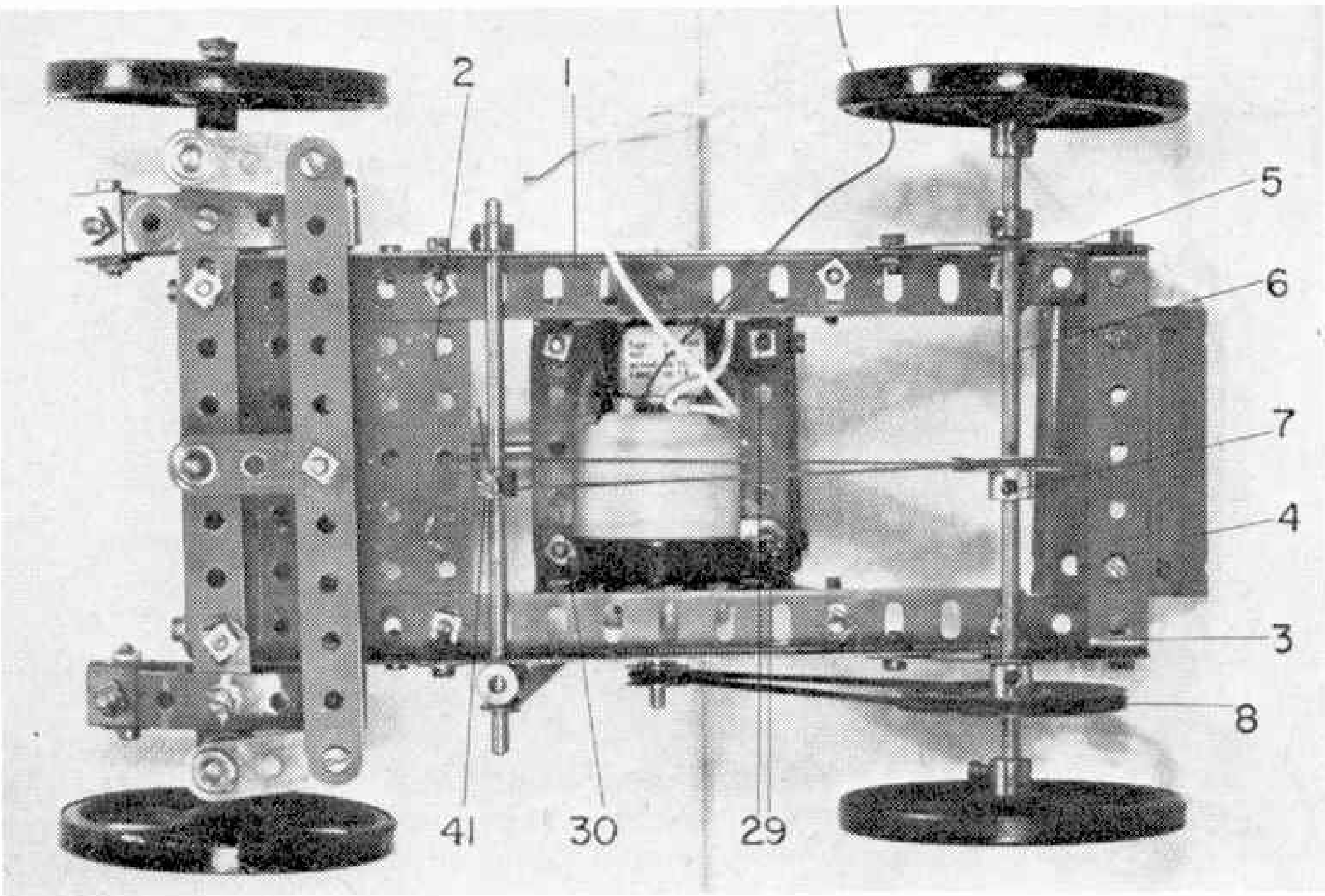
1—2	1—14	67—37b	5—90a
1—3	1—15b	12—38	2—111
10—5	1—15c	3—48a	3—111c
2—6	2—18a	2—48b	2—111d
2—8b	4—19a	1—53	1—115
1—9b	1—19g	7—59	4—133a
2—9d	1—20a	5—62	1—186b
2—9f	1—22	2—63	1—190a
8—11	1—23a	1—72	2—199
6—12	83—37a	2—82	4—221
1—Power Drive Unit		2—90	1—235d

Top left: A simple, but amazingly realistic model in Meccano of the first car produced by Henry Ford in 1898. The petrol engine of the original is replaced in the model by a Power Driven Unit.

At right: An underside view of the 1898 Ford showing the simple yet extremely strong chassis construction.

Below left: Working "handle" steering is fitted to the model of Ford's first car. The layout of the steering mechanism is clearly shown in this picture.

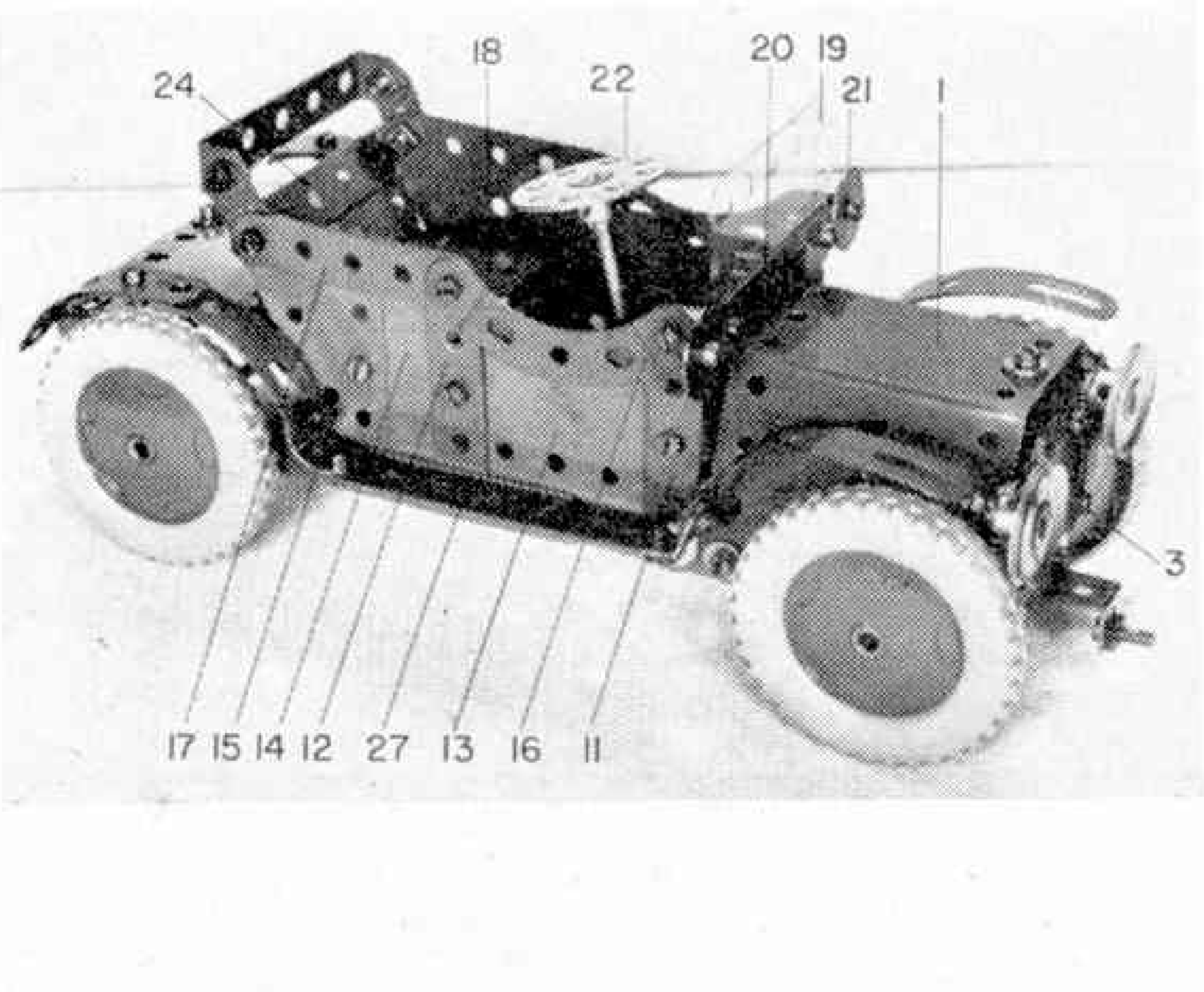
Below: "Tin Lizzie", perhaps the most famous of all Ford cars. This particular model is based on the 1908 Ford T and is built with Meccano Outfit No. 4.



the chassis is a 3½ in. Rod 24 held in place by a Crank 25 beneath Strip 14 and by a Coupling 26 above the Double Angle Strip. A Crank Handle 27, carrying a Collar on its end, is fixed in one end transverse bore of the Coupling. Secured in the centre hole of Strip 17 is a Threaded Pin 28 engaging with the elongated hole of Crank 25.

In the case of the driver's seat two 2½ in. Angle Girders 29 are bolted to a 2½ × 2½ in. Flat Plate 30. Fixed to the vertical flange of each Girder 29 is a 2½ × 1½ in. Triangular Flexible Plate edged by a 2 in. Strip 31, a 1 in. Corner Bracket 32, a 2½ in. Curved Strip 33 and two supporting 2½ in. Strips 34. The back is enclosed by three 2½ × ½ in. Double Angle Strips 35, the uppermost Strip overlayed by a 2½ in. Stepped Curved Strip 36. A Power Drive Unit is fixed by ⅜ in. Bolts to the underside of Flat Plate 30 and a ½ in. Pulley on its output shaft is connected by a 10 in. Driving Band to Pulley 8. The completed seat is then fixed to Girders 1 by Angle Brackets.

Fitted to the model is a band brake the handle of which consists of a 4½ in. Narrow Strip 37 attached to a Coupling 38, fixed on a 5 in. Rod 39 held in Angle Girders 1 by Collars. A further Collar 40, carrying a Bolt 41 in one transverse tapped bore, is fixed on the Rod and a length of Cord is tied to Bolt 41, is passed around Pulley 7, then brought back and secured to Flanged Plate 2 in such a way that the Cord acts as a brake when the Narrow Strip is moved backwards.



Model T

Before describing our second model I should like to say that the Ford Motor Company began serious production with the Ford Model A and subsequently progressed through a series of models, identified by letters, until, in late 1908, the first Model T emerged from the Ford factory at Dearborn, Michigan, U.S.A. This vehicle was the culmination of years of work and experience obtained from the earlier models and combined lightness with power and durability, while still being comparatively low in price. Although the Model T was made for many years our Meccano version is based on the original 1908 example and can be built with Outfit No. 4.

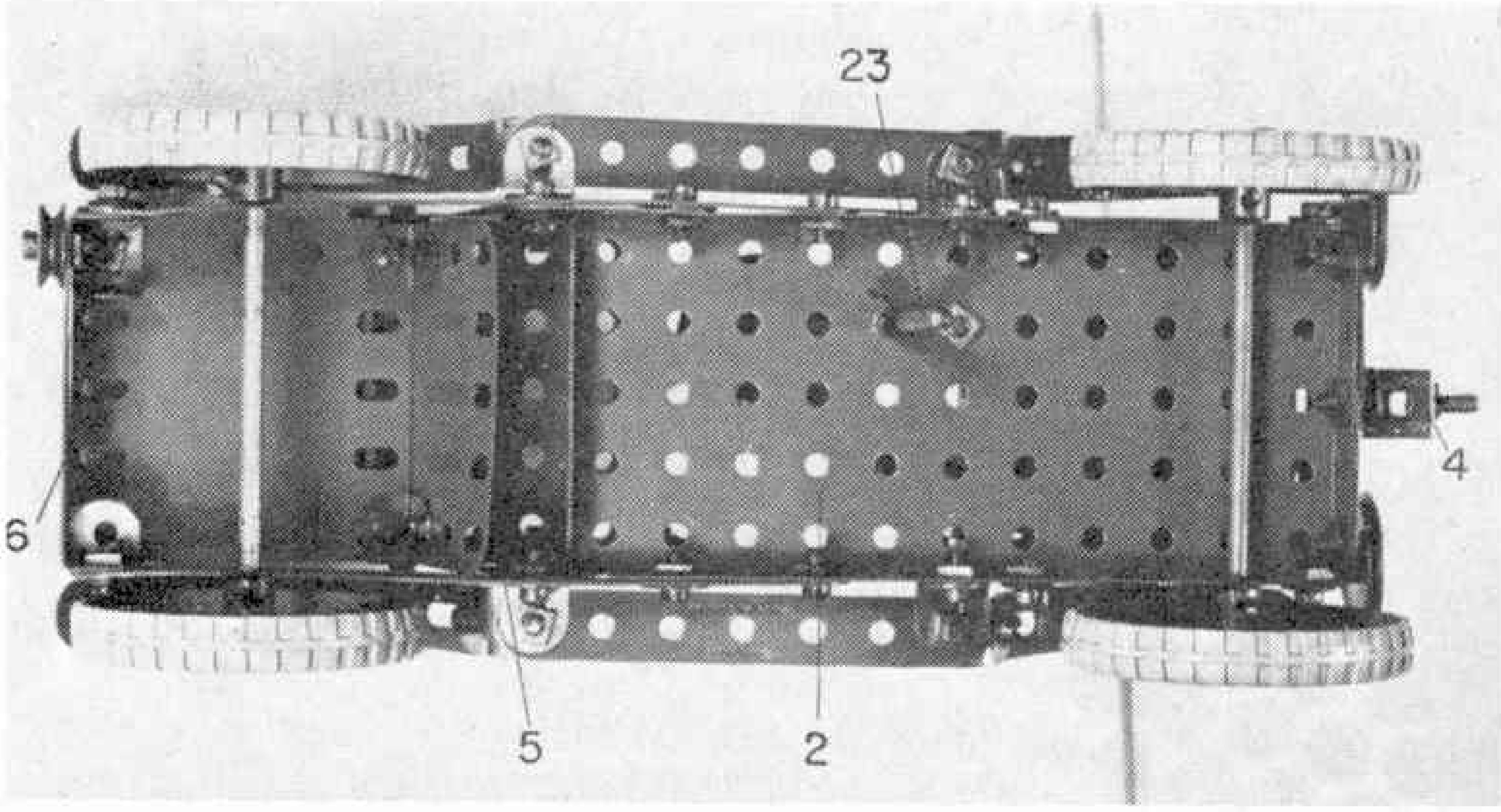
The bonnet is produced from a 5½ × 2½ in. Flexible Plate 1 bent to shape and bolted to the flanges of a 5½ × 2½ in. Flanged Plate 2. Two Flat Trunnions 3, joined together at their apexes by a 1½ × ½ in. Double Angle Strip are bolted to the front flange of Plate 2 then the engine starting handle is supplied by a ½ in. Reversed Angle Bracket 4 loosely lock-nutted on a Bolt fixed in the centre hole of the front flange of Flanged Plate 2. A ⅜ in. Bolt is fixed by a Nut in the free lug of the Reversed Angle Bracket.

Ordinary Angle Brackets are attached to the sides of the bonnet and 1 in. Pulley Wheels are fixed to these with ⅜ in. Bolts to represent what on the original car are acetylene headlamps. A Bolt fitted with a Washer represents the radiator cap.

Flanged Plate 2 is now extended by two 5½ in. Strips 5 joined at the rear by a 2½ × ½ in. Double Angle Strip 6, then Fishplates 7 are used to fix a further 2½ × ½ in. Double Angle Strip 8 to Double Angle Strip 7, the upper securing Bolts also fixing two Double Brackets in place. Bolted to the upper lugs of these Double Brackets is a 2½ × 2½ in. Flexible Plate 9, while a ½ in. Pulley without boss 10 is bolted to Double Angle Strip 6.

Each side of the car is built up from two 2½ in. Strips 11 and 12, a 2½ × 2½ in. Flexible Plate 13, a 2½ × 1½ in. Flexible Plate 14 and a 2½ × 1½ in. Triangular Flexible Plate 15. A 2½ in. Stepped Curved Strip 16 is bolted between the tops of Strips 11 and 12, while a 2½ in. Strip 17 is used to edge the top of Plates 14 and 15, also being bolted to Strip 12.

The seat consists of a 2½ × 1½ in. Flanged Plate 18, bolted as shown between the sides. The windscreen,



At left: The basic chassis of the Meccano Model T is highly simple, as this underside view shows.

Below: Construction of the radiator and bonnet of the Model T is evident from this close-up view of the front of the model.

Below left: A rear view of the Model T showing construction of the boot and rear mudguards. Note the rear " light ".

on the other hand, is a 2½ × 1½ in. Transparent Plastic Plate 19 held between a 2½ × ½ in. Double Angle Strip and a 2½ in. Strip 20, the Double Angle Strip being bolted to Strips 11 at each side, the securing Bolts also holding Angle Brackets in place. Two ¾ in. Washers 21 are attached one to each of these Angle Brackets to represent side lamps. No working steering mechanism is included in this model but an imitation steering wheel is represented by an 8-hole Bush Wheel 22 fixed on a 3½ in. Rod 23 held by Spring Clips in Flanged Plate 2 and in a ½ × ½ in. Reversed Angle Bracket bolted to the Plate.

Returning to the seat, a 2½ × ½ in. Double Angle Strip 24 is bolted between Triangular Flexible Plates 15, the securing Bolts also holding in position two Fishplates which are themselves joined by another 2½ × ½ in. Double Angle Strip 25, the latter representing a folded hood. A 2½ × 2½ in. Flexible Plate 26 is bolted to Double Angle Strip 24 to act as the seat back, also being attached by Angle Brackets to Flexible Plate 9.

At each side of the model, combined running board and mudguards are supplied by a 3½ in. Strip 27, to each end of which a Formed Slotted Strip is attached by an Obtuse Angle Bracket, Strip 27 itself being attached to the side of the model by ordinary Angle Brackets. The rear Formed Slotted Strip is extended by a 2½ in. Strip 28, then the model is completed by four 2½ in. Road Wheels mounted on 3½ in. Rods journalled as shown in the chassis members.

As a matter of interest, the Road Wheels can be given a more realistic appearance by painting in a number of spokes the original " Tin Lizzie " being fitted, as it was, with spoked wheels.

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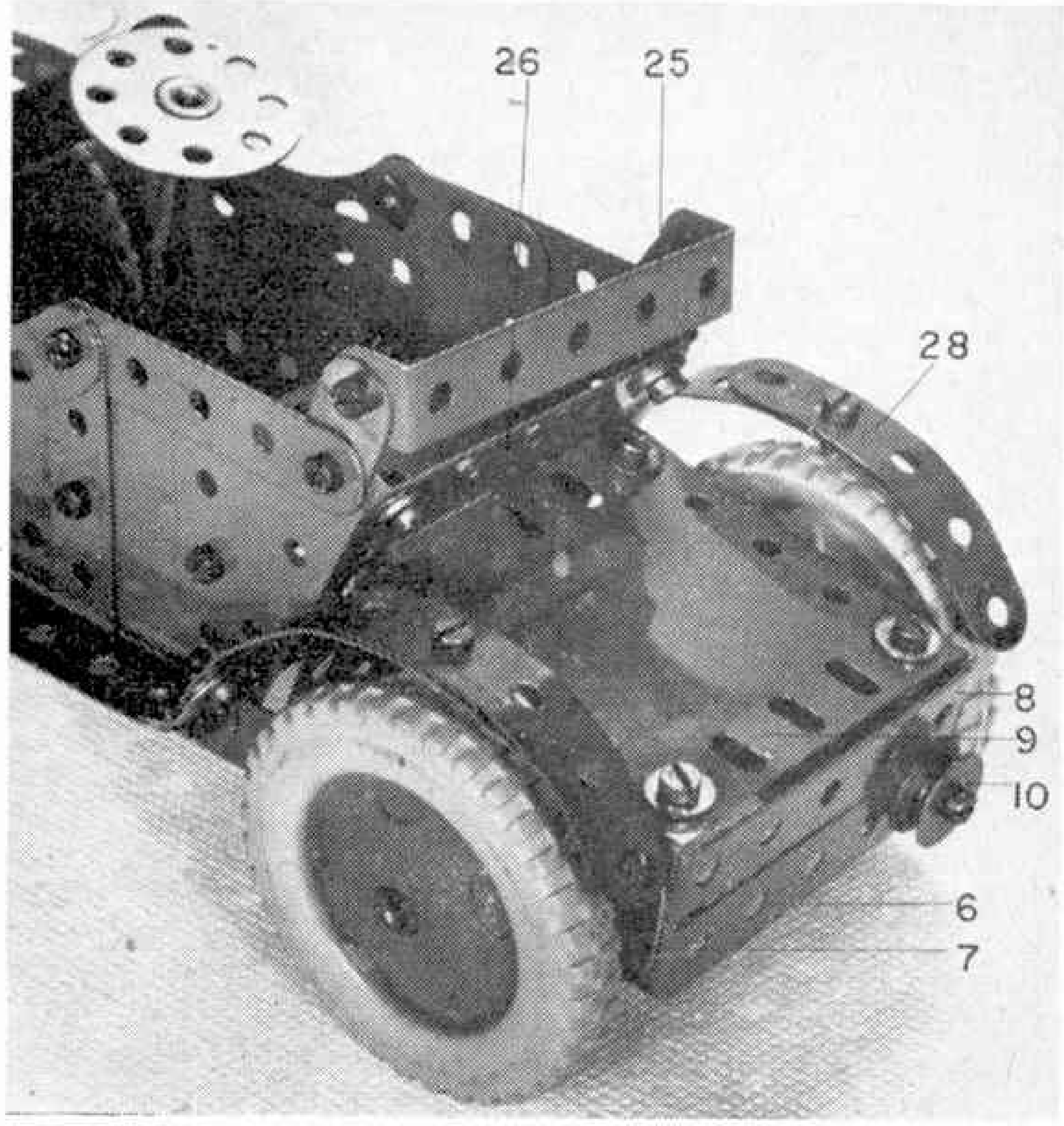
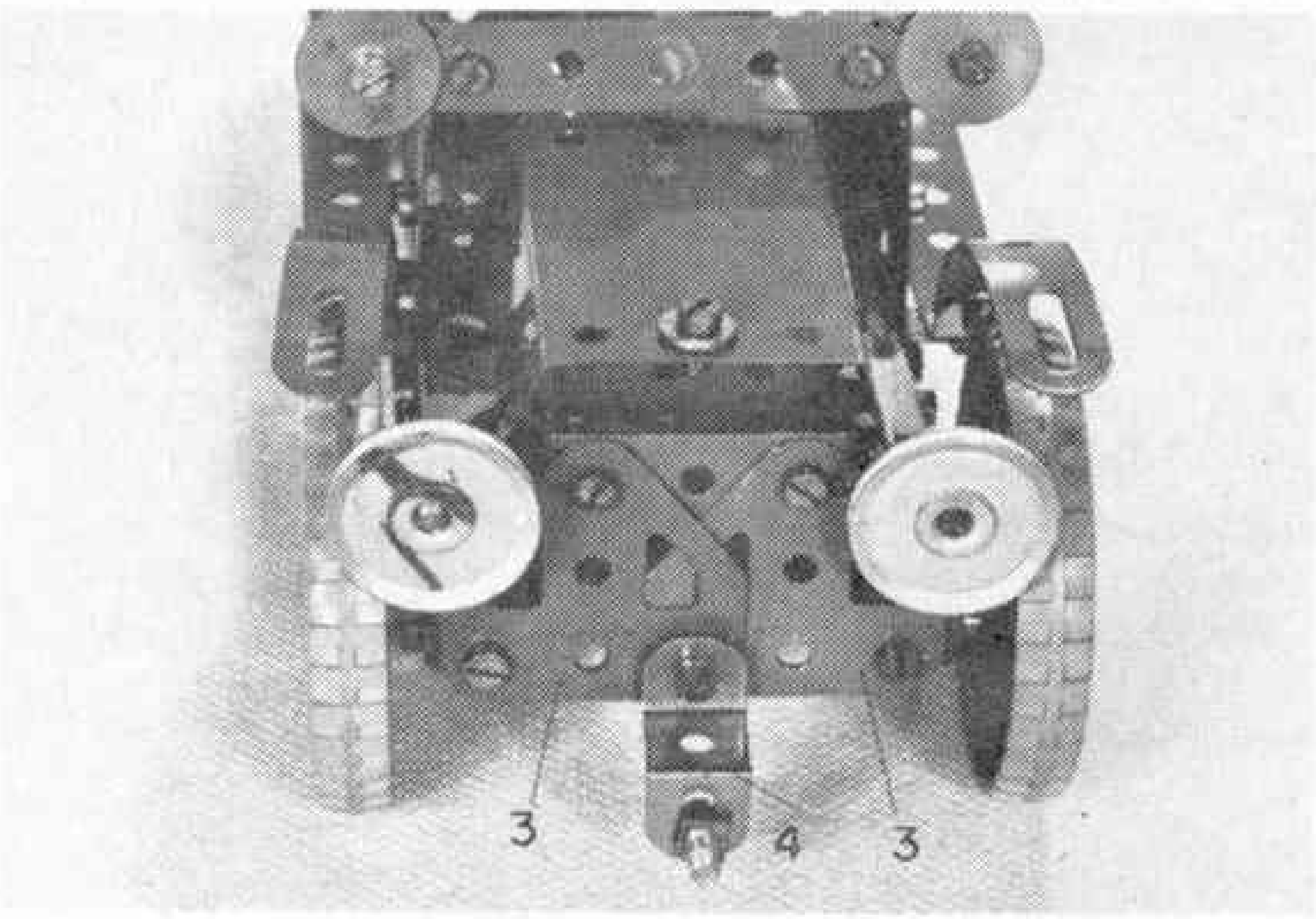




PARTS REQUIRED

2—2
2—3
9—5
4—10
2—11
10—12
4—12c
3—16
2—22
1—23
1—24
2—35
65—37a
59—37b
10—38
2—38d
1—48
5—48a
1—51
1—52
2—90a
5—111c
2—125
2—126a
4—187
2—188
2—190
1—192
1—193
2—194
4—215
2—221

FORK LIFT

by Spanner

A popular subject modelled from an Outfit No. 1, for the younger readers. Very easy to construct.

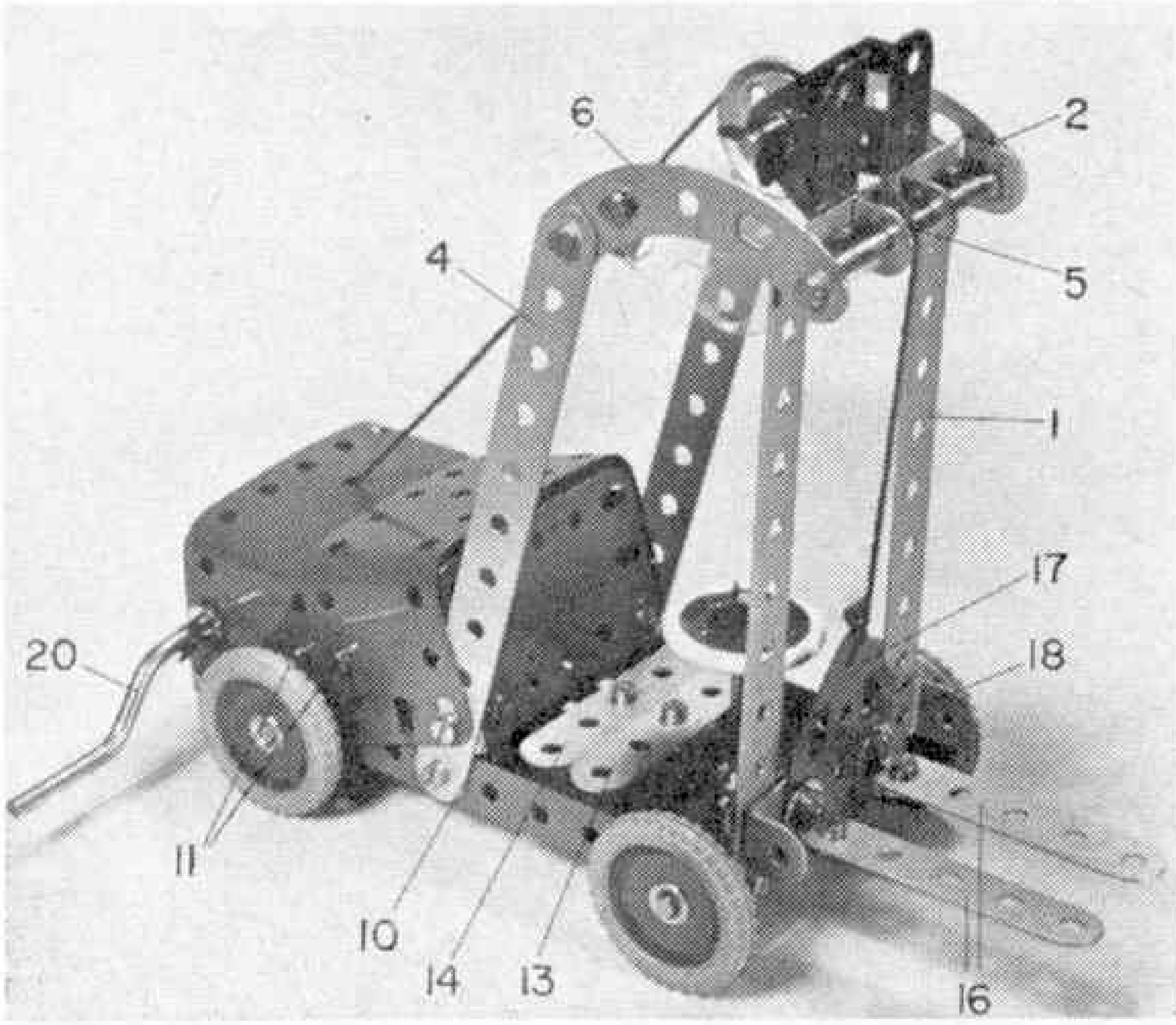
MECCANO OUTFIT No. 1, for obvious reasons, is regarded as one of the beginners' Outfits. Generally, it is used either by young children who are not able to cope with larger Outfits, or by new-comers to the hobby to enable them to get the " hang " of the system before advancing onto bigger and better things. Beginners' set or not, however, the No. 1 Outfit can be used to produce an amazing number of models, many of which are surprisingly detailed and realistic considering the quantity of parts contained in the set, and the Fork Lift Truck described below is just one model which proves this to be correct. It uses comparatively few parts and yet it looks very smart indeed, as I am sure you will agree. What.s more, it works pretty well, too !

Assembly of the model is quite straightforward. Two 5½ in. Strips 1, connected at the top by a 2½ × ½ in. Double Angle Strip 2, are bolted to one end flange of a 5½ × 2½ in. Flanged Plate 3. A further two 5½ in. Strips 4 are fixed one to each side flange of the Flanged Plate, then a Double Bracket 5 is bolted to the centre of Double Angle Strip 2, after which the tops of Strips 4 are connected to the lugs of the Double Angle Strip by 2½ in. Stepped Curved Strips 6. Before the forward securing Bolts are fitted, however, a 2 in. Rod is mounted in the lugs of Double Bracket 5, this then being held in place by the securing Bolts once they are fitted. Fixed to the back of the Double Angle Strip are two Trunnions, in the apex holes of which a 1 in. Rod, carrying a 1 in. loose Pulley 7, is held by Spring Clips. A guard beneath this Pulley is provided by a 2½ × 1½ in. Transparent Plastic Plate, attached to Stepped Curved Strips 6 by Angle Brackets.

At the rear of the model, a 5½ × 1½ in. Flexible Plate 8 is now bent to shape and bolted between the side flanges of Flanged Plate 3. Another 5½ × 1½ in. Flexible Plate 9 is similarly shaped and bolted at an angle to Strips 4, the securing Bolts also fixing in place two Angle Brackets to which a 2½ × 1½ in. Plastic Plate 10 is bolted. Plate 9 is attached to Plate 8 by Fishplates held by Bolts 11 at each side.

Before completing the body section of the model, it is advisable to build the steering wheel, seat and fork lift sections. An 8-hole Bush Wheel 12 is bolted to the top of Flanged Plate 3 in the position shown, the rearmost securing Bolt also fixing a ½ in. Reversed Angle Bracket in place. Bolted to the centre of this Reversed Angle Bracket is an ordinary Angle Bracket, to the free lug of which a 2½ in. Strip 13 is fixed. Another 2½ in. Strip 14 is fixed to the free lug of the Reversed Angle Bracket then a 2 in. Rod is secured in the boss of Bush Wheel 12. Held by Spring Clips on the end of this Rod is a 1 in. loose Pulley 15 fitted with a Rubber Ring.

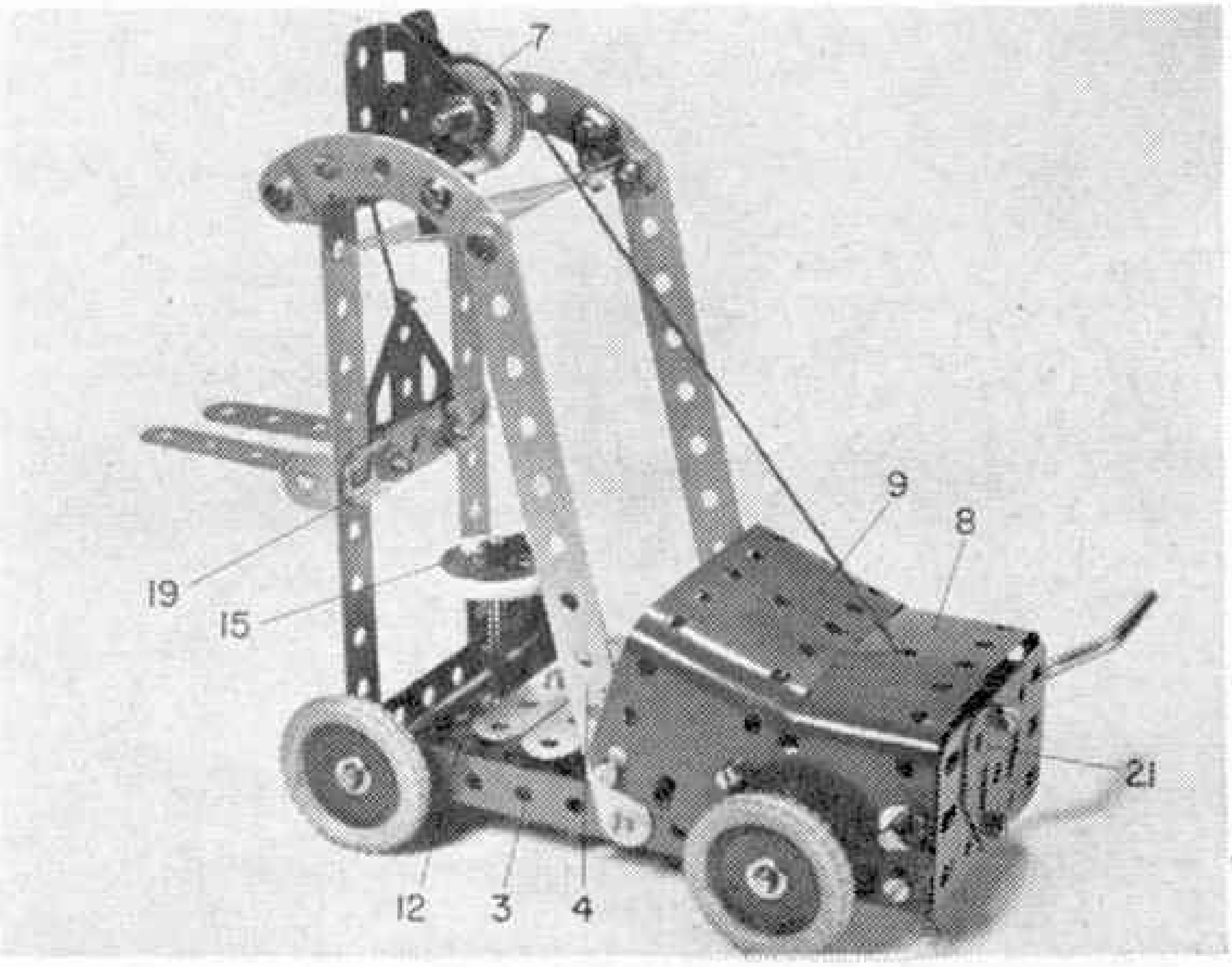
The lifting fork consists of two 2½ in. Strips 16 bolted to Angle Brackets which are in turn fixed by ⅜ in. Bolts to a Flat Trunnion 17 mounted on a 2½ × ½ in. Double Angle Strip 18. After being passed through the Angle Bracket, Flat Trunnion and Double Angle Strip, each ⅜ in. Bolt is fitted with a Washer and a Fishplate 19, then all the parts are secured by a Nut. The Washers, of course, space the Fishplates from the Double Angle Strip, allowing the completed assembly to be mounted on 5½ in. Strips 1, the Strips locating between the Fishplates and the Double Angle Strip and acting as runners. Once mounted, a length of Cord is tied to the apex of Flat Trunnion 17, is passed over the Rod mounted in Double Bracket 5, over Pulley 7, then is brought down and threaded through the centre hole in Flexible Plate 8 to be secured to a 3½ in. Crank Handle 20, held by Spring Clips in Flexible Plate 8.

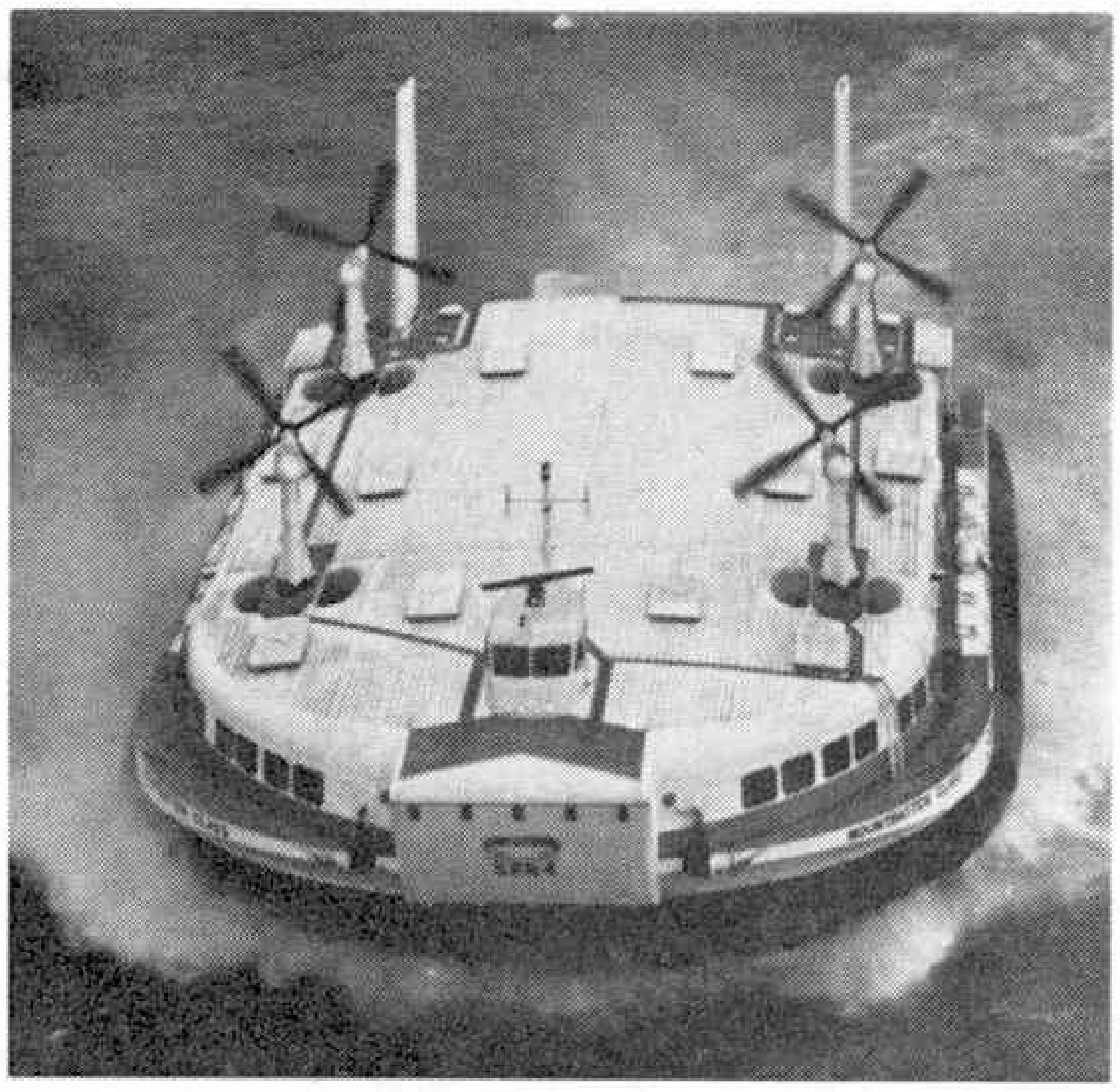


Finally, the model is finished by adding a back to the body and the wheels to the chassis. The former consists of a 2½ × 1½ in. Plastic Plate, bolted to the rear end flange of Plate 3 and overlayed by a Flat Trunnion 21, while the latter are 1 in. Pulleys with Motor Tyres fixed on 3½ in. Rods journalled in the side flanges of Plate 3.

PARTS REQUIRED

4—2
4—5
4—10
1—11
6—12
2—16
1—17
1—18b
1—19s
4—22
2—22a
1—24
6—35
33—37a
30—37b
8—38
1—40
2—48a
1—52
2—90a
3—111c
2—126
1—125
2—126a
1—155
4—142c
2—189
1—193
2—194





At left: The first 165-ton car-carrying hovercraft SRN4 at sea after her launching at East Cowes, Isle of Wight, in Feb. 1968.

TRAVEL ON AN AIR CUSHION

Hovercraft transportation is one of the fastest developing modern industries. Amateur enthusiasts even construct their own for races and trial meetings.

by W. H. Owens

FEW INVENTIONS of recent times have attracted such universal interest, or opened up such exciting possibilities for surface travel, as the hovercraft—the revolutionary British air-cushion vehicle that skims over land or water at high speeds, and is able to negotiate various obstacles that defy more conventional means of transport.

Development of the hovercraft has been remarkable in that it has emerged as a commercially successful form of transport in so short a time. It is only ten years since the inventor, Christopher Cockerell, demonstrated his original model and the idea was taken up by the National Research Development Corporation. In 1959, just one year later, the world's first full-scale hovercraft—the famous Westland SRNI—made the headlines by crossing the English Channel.

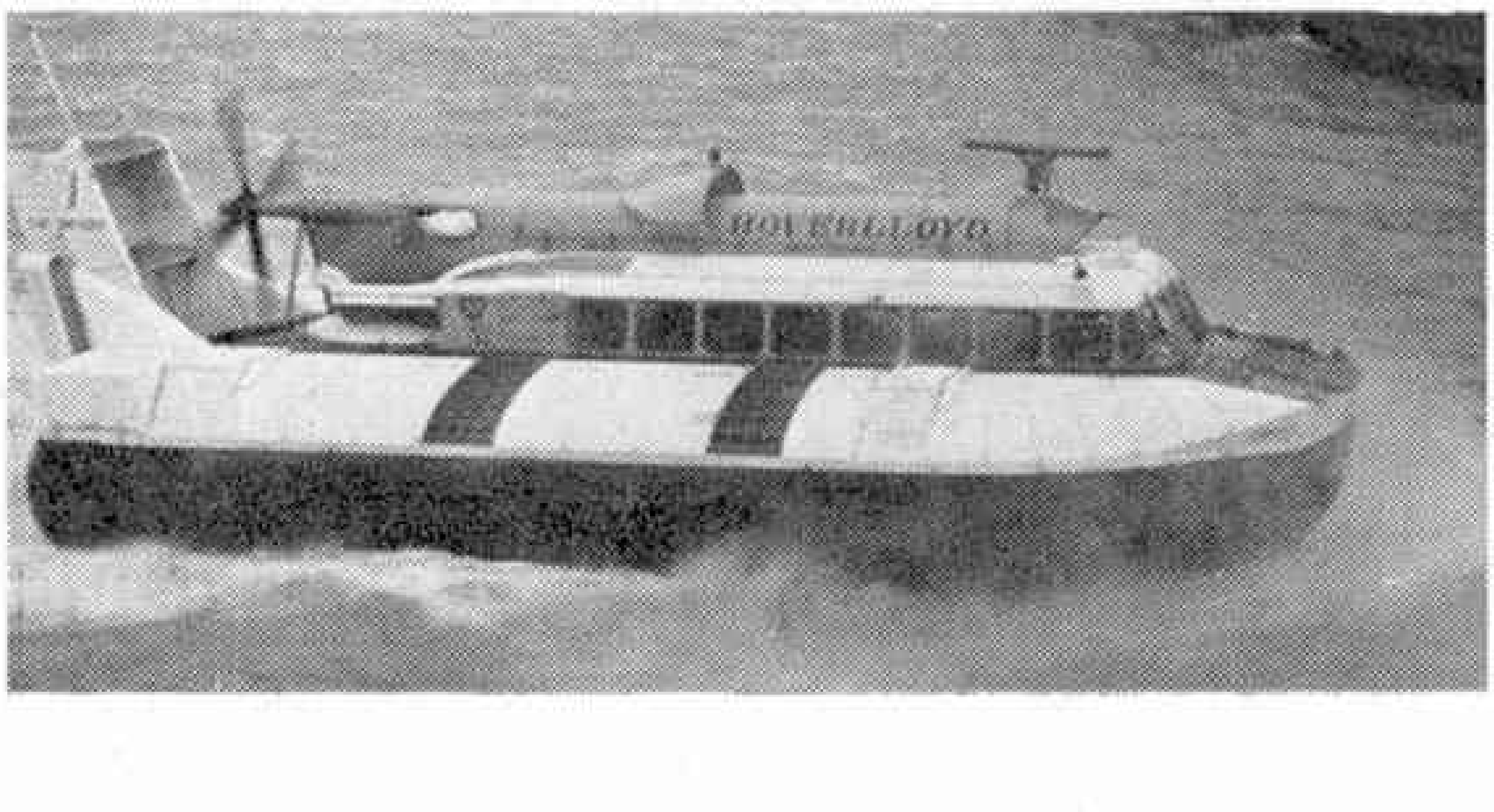
Since then rapid progress has been made by the hovercraft industry. After ten years of continuous research and practice, Britain's fund of technical know-how in designing air-cushion systems, and her wealth of experience in operating them, still surpasses that of any other country.

British light hovercraft have demonstrated the amazing versatility of this new form of transport under difficult operational conditions at home and overseas. They have triumphed through trials in deltas and deserts, over snow and ice, swamps and bog-ridden ground. Even river rapids, sandbanks and quicksands offer no hindrance to these go-anywhere vehicles, which are highly suitable for rescue work or as survey craft in remote and inaccessible areas.

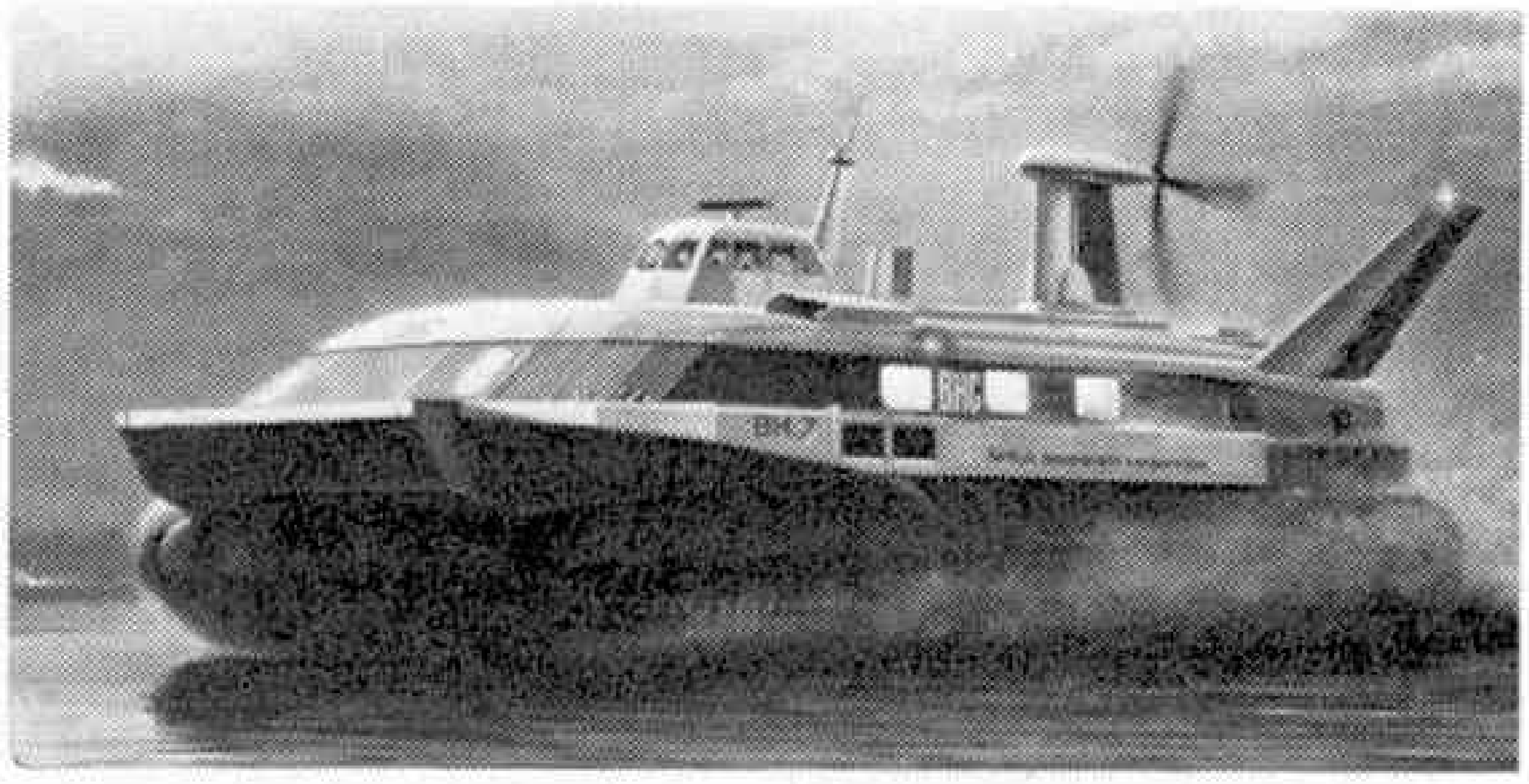
Development of the tracked hovercraft, or hovertrain, has also been under way. A track for full-scale trials with an experimental hovertrain is being built in the Cambridgeshire fen country, and in France work is well advanced on the Bertin Aerotrain based on the air-cushion principle. Hovertrains operating at 300 m.p.h. could revolutionise today's inter-city rail services, while such rapid-transit commuter systems in and around the big cities could materially reduce road congestion where it is worst.

Until this year, however, commercial hovercraft operations have been confined to passenger carrying services over estuaries or short-sea routes. The first experimental passenger service was run in 1962 with a Vickers VA3 24-seater hovercraft across the Dee estuary, between Wallasey and Rhyl. In the same year the first Solent service, linking Ryde with Southsea, was launched with a Westland SRN2. This service was so successful that after three summer seasons the operators, Hovertravel Limited, put it on a daily year-round basis.

Since 1965, Hovertravel have carried more than 500,000 passengers to and from the Isle of Wight. The company now uses 38-seater SRN6's. Another 200,000



Below: One of the two SRN6 hovercraft operating on the first cross-channel passenger service seen entering Ramsgate Harbour after a trip from Calais. Below left: As much at home over land as over water, an SRN5 hovercraft speeds across scrub land.



Artist Laurie Bagley's impression of the 40-ton BH7. The British Government has already announced its intention to order two BH7's for evaluation in the fast patrol and logistic support roles. A civil variant of this hovercraft is also planned.

or so passengers have been hovered over the Solent by British Rail's "Seaspeed" services, from Portsmouth and Southampton, which commenced in 1966. In that year also, Hoverlloyd Limited launched the first scheduled cross-channel passenger service, between Ramsgate and Calais, with two of the well-tried SRN6 hovercraft.

On August 1st, 1968, the world's biggest hovercraft yet—the 165-ton SRN4 'Mountbatten' class—began a passenger/car ferry service on British Rail's cross-channel route between Dover and Boulogne. The SRN4 carries up to 254 passengers and 30 cars per trip, or over 600 passengers without cars.

This giant craft, with a maximum cruising speed of 60-70 knots, has reduced crossing times of the English Channel by car ferry from 90 minutes to only 30-35 minutes. Passengers are seated in comfortable lounges either side of the central car deck.

British Rail's SRN4 operates from a new hoverport built adjacent to the Dover Car Ferry Terminal, and there are similar facilities at Boulogne. Another and larger interenational hoverport is under construction at Pegwell Bay, Ramsgate, where Hoverlloyd Limited will commence car ferry services to and from Calais with two SRN4's early in 1969.

If you have watched a hovercraft taking off or landing on a South Coast beach, you will probably have been fascinated by the way in which the craft rises up on its "skirts" before entering the water, or subsides on them again at the end of a trip. These flexible skirts form a curtain around the base of the craft, and extending well below it, and the cushion of pressurised air is confined between the base and the water or land surface over which it travels. This, of course, is the unique and revolutionary feature of the hovercraft.

The air cushion is kept in place by a curtain of higher pressure air acting upon it in an inward and downward direction all round. It is this sustained pressure, plus the mechanical propulsive force, that enables a hovercraft—once it has left the ground—to move forward on a straight, horizontal course at high speed.

In the early days, hovercraft could operate only in calm waters and obstacle clearance was measured in inches. But with the development of the long, flexible skirt, a craft was able to ride fast and smoothly in open waters like the Dover Straits. The 'Mountbatten', for example, will operate with perfect safety and give passengers a smooth ride in seas up to 12 feet high. On land or at sea, obstacle impact is cushioned by the bending of the flexible skirts.

The world's largest hovercraft manufacturers are the British Hovercraft Corporation Ltd. (a subsidiary of Westland Aircraft), whose greatest achievement so far is, of course, the 'Mountbatten' class. Others in production include the highly successful 'Winchester' (SRN6) and the 'Warden' (SRN5) classes. The Corporation's latest project is the 'Wellington' (BH7), the first hovercraft to be designed primarily for military purposes. It has been ordered by the Royal Navy as a fast patrol boat.

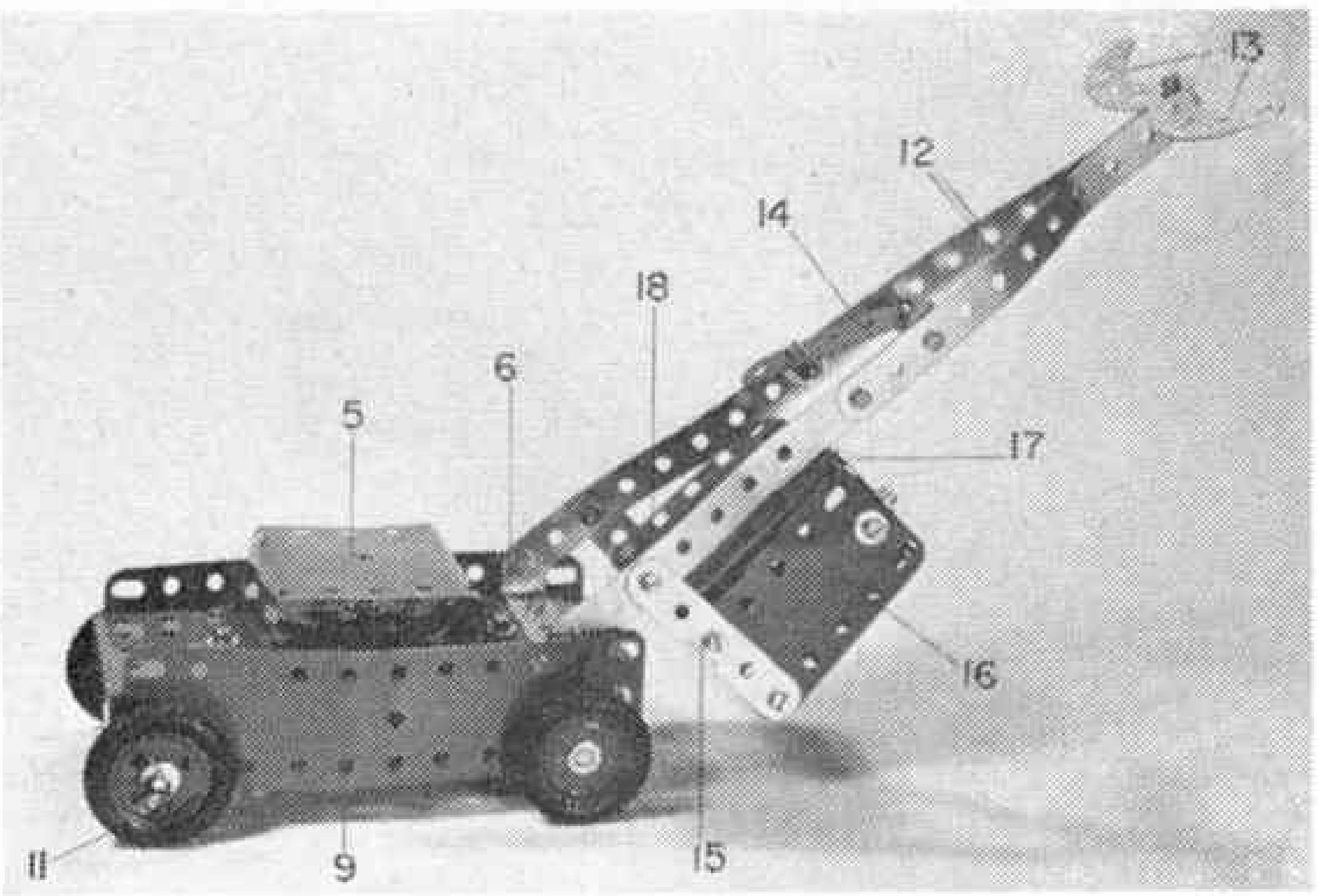
A different type is the new HM-2 sidewall hovercraft, developed by Hovermarine Limited, which is being operated on the "Seaspeed" Isle of Wight services of British Rail. This craft has the air cushion contained along its sides by rigid sidewalls, which are immersed underwater to a depth of about nine inches when hovering, and by flexible skirts at the bow and stern. The HM-2 is a 60-seater, but larger sidewall craft are being developed which will be capable of carrying up to 400 passengers.

Looking towards the exciting future of hovercraft, the ocean-going hovership of several thousand tons—able to make an Atlantic crossing in hours instead of days—is now within sight. However, the next stage of development of the larger open water hovercraft will probably be something in the 400-600 ton range.

Meanwhile, the air cushion principle is also being applied to industrial plant and vehicles. For example, there is the hoverpallet, capable of lifting loads from one to five tons, which has proved its worth in factories, docksides and ships. Another development is the overland transporter with an inbuilt air-cushion system between the front and rear wheels. This is used to assist with the moving of heavy loads over, for example, unprepared ground like farmland or weak road bridges. Normally the road transporter is towed on its wheels, but on reaching a bridge unable to bear the load weight, the air-cushion system is brought into use.

Is the hovecraft a ship or an aircraft? It is, of course, neither. Yet its status has never yet been properly defined. However, this state of affairs will be remedied by the Hovercraft Bill now going through Parliament—the first legislation of its kind in the world—which will establish the versatile hovercraft in its own right and give it a separate identity from either ships or aircraft.

The Vickers 24 seater that crosses the Dee estuary the VA-3 hovercraft, off Rhyl during the first passenger service, July 1962.



Built with Meccano Outfit No. 2, this model is based on a rotary mowing machine and incorporates an imitation rotary cutter driven via a Driving Band from the rear axle.

Rotary Mower

by Spanner

An Outfit No. 2 model for the younger Meccano constructors.

LAWN MOWERS, to most people, are machines to be avoided as much as possible. Every householder equipped with a lawn, of course, is anxious to obtain a mower. In fact, he probably regards it as an essential piece of equipment, but I'll guarantee that he will only really like it when it is being used to cut his lawn—*by somebody other than himself* !

By far the most popular lawn mower in use in this country is the common roller mower, with its transversely-mounted " drum " of cutting blades in front of a heavy roller, but this is by no means the only type of mower in existence. The rotary mower, for example, is also popular, particularly with local councils who frequently use it for cutting such things as roadside grass verges, etc. Motor-driven, this machine runs on wheels and has, instead of a cutting " drum ", a cutting rotor on a vertically-mounted axle. It forms the inspiration for the simple No. 2 Outfit model featured here and, although not driven by a motor, it does have a revolving rotar run from the rear axle when the model is pushed along.

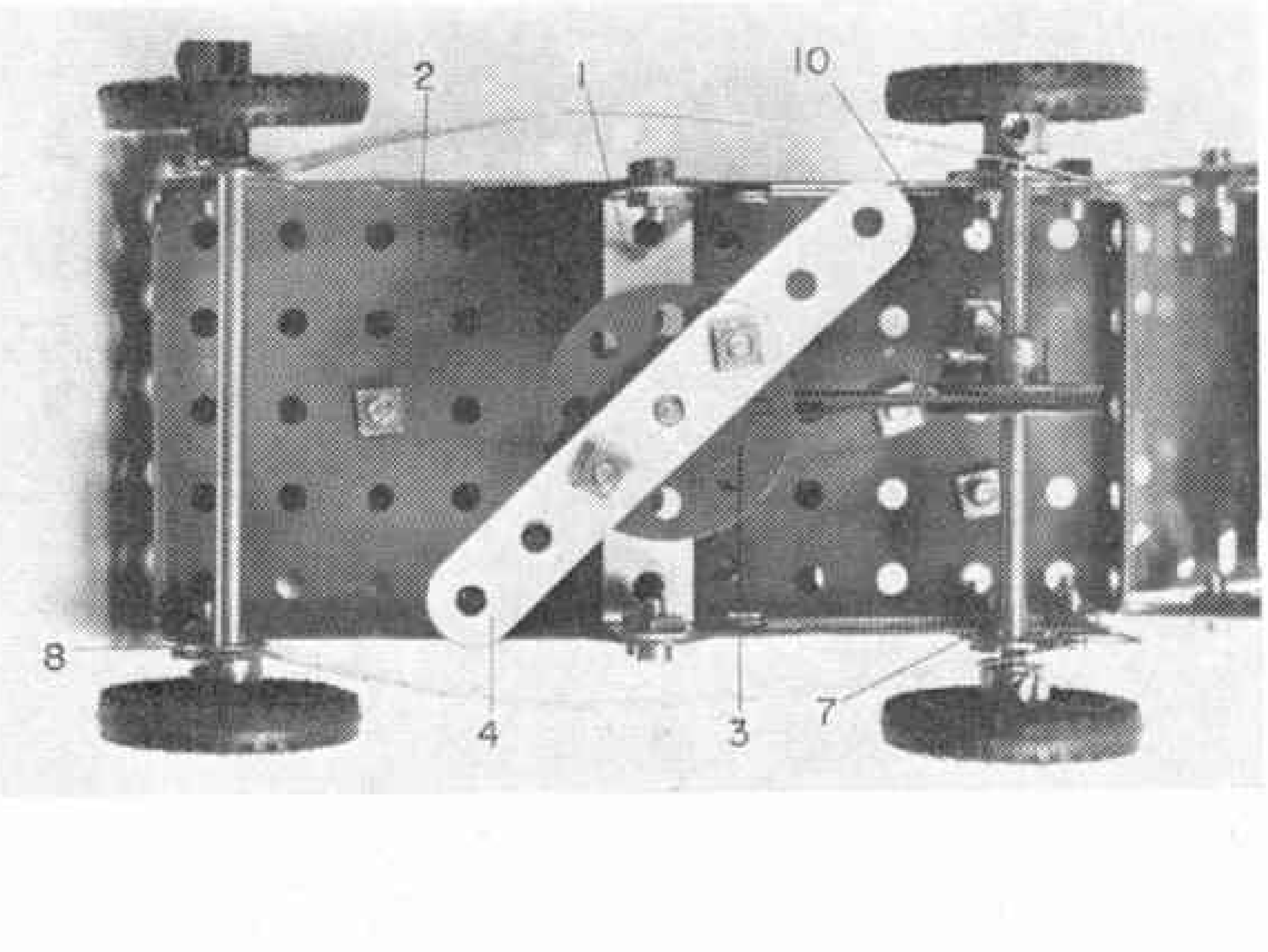
Construction is pretty obvious from the accompanying illustrations. Two Trunnions connected by a 2½ × ½ in. Double Angle Strip 1 are bolted to the underside of a 5½ × 2½ Flanged Plate 2. Journalled in the centre hole of this Flanged Plate and in the Double Angle Strip is a 2 in. Rod carrying a 2 in. Pulley above the Plate and an 8-hole Bush Wheel 3 beneath the Double Angle Strip. A 3½ in. compound strip 4, obtained from two 2½ in. Strips overlapped three holes, is bolted across the Bush Wheel, as shown, and note that a short length of Rod should be visible between the Bush Wheel and Double Angle Strip 1. This is important as the operating Driving Band will later be passed round this section of the Rod.

A top cover for the 2 in. Pulley is next provided by a 4½ × 2½ in. Flexible Plate 5, bent to shape and fixed to the top of Flanged Plate 2. A 2½ × ½ in. Double Angle Strip 6 is also fixed to the top of the Plate, while two Fishplates 7 and 8 are bolted to each side flange of the same Plate. Fishplate 7 is fixed through the second hole in the flange, while Fishplate 8 is fixed in the end hole, the securing Bolt in the latter case also helping to hold a 5½ × 1½ in. Flexible Plate 9 in place. This Plate is curved to avoid the heads of the Bolts already fixed in the side flange of Flanged Plate 1, and is bolted through the end holes in the flange. Journalled in Fishplates 7 and 8 at each side and in the appropriate holes of Plates 9 are two 3½ in. Rods, that at the rear carrying a 1 in. fixed Pulley 10 and held in place by two further 1 in. fixed Pulleys, each fitted with a Motor Tyre. The forward Rod carries a 1 in. fixed Pulley with Motor Tyre at one end and a 1 in. loose Pulley with Tyre 11, held in place by a Spring Clip, at the other end. A 2½ in. Driving Band is passed round Pulley 10 and the Rod carrying Bush Wheel 3.

We are now left with only the handle and imitation motor casing to finish. Two 9½ in. compound strips 12 are each built up from two 5½ in. Strips overlapped three holes, are curved gently to the shape shown, and are bolted one to each lug of Double Angle Strip 6. The compound strips are then fixed together at the top, with an Angle Bracket between them, two 2½ in. Stepped Curved Strips 13 being bolted to the free lug of this Angle Bracket. A 2½ in. Strip 14 is connected to the compound strips by Angle Brackets to act as a bracer, then two further 2½ in. Strips 15 are bolted one to each compound strip through its third hole. A 2½ × 1½ in. Flexible Plate 16 is, in turn, bolted to each of these Strips, Plates 16 being connected by a 2½ × 1½ in. Plastic Plate 17, attached by Angle Brackets. Finally, two 2½ × 2½ in. Flexible Plates 18 are attached to Plates 16 and 17 also by Angle Brackets.

PARTS REQUIRED

4—2
5—5
4—10
8—12
2—16
1—17
1—20a
4—22
1—22a
1—24
1—35
40—37b
40—37a
10—38
2—48a
1—52
2—90a
2—126
4—142c
1—186
2—188
2—189
2—190
1—191
1—194



An underside view of the mower showing the imitation rotary cutter and the method used to drive it.

GREAT ENGINEERS No. 14

SIR CHARLES A. PARSONS (1854–1931)

by A. W. Neal

CHARLES ALGERNON PARSONS was the youngest of six sons of the third Earl of Rosse. His father was distinguished both as an engineer and as an astronomer, and was a President of the Royal Society.

Charles Parsons never went to school, but had the benefit of private tuition, and spent much of his childhood leisure time in a well equipped workshop attached to Birr Castle in Ireland. When he reached the age of 17, Charles entered Trinity College, Dublin and won a prize 'for progress in Mathematics'. Two years later he was at St. John's College, Cambridge, taking his B.A. degree in the Mathematical Tripos of 1877.

During 1877 he became a top pupil with W. G. Armstrong & Co., at Elswick. Here he was allowed to work on an engine he had designed whilst at the University. This engine was coupled to a dynamo and supplied electricity for an arc lamp on the jetty at Elswick. Easton & Anderson of Erith then made a number of these engines with good results.

Parsons left Armstrong's in 1881 and joined Kitson's of Leeds, where his job was to carry out experiments on the rocket-propulsion of torpedoes, but this project was eventually abandoned.

Later he became a partner in the firm of Clarke, Chapman & Co. and took command of their electrical department. This was at the time when electricity was beginning to make an impact, and local authorities and companies were establishing supply undertakings to make electricity available to the general public. The piston type steam engine was not altogether ideal for large scale generation and there was a need for a prime-mover of the purely rotary kind which could be coupled directly to a dynamo. The answer to this was to be the high speed turbine.

The earliest recorded steam engine (dated about 2,000 years ago) was of the turbine variety, and in the 19th century a number of inventors devoted a lot of time to its development, de Laval and Curtis were but two. It is for his work in this field that Charles Parsons will always be remembered.

Parsons had many problems to solve before his various designs could be incorporated in a turbine of his liking, but all was achieved in due time. His first steam turbo-generator was finished in 1884, the same year as he took out patents covering his ideas. This machine was in regular use at Gateshead for some years and provided electricity for public lighting.

The partnership with Clarke and Chapman lasted until 1888 and some 360 turbo-generators were constructed in that time. In the following year Parsons, with the financial help of others, established his own works at Heaton. Because of the old partnership agreement, he was unable to construct the axial flow steam type based on his first patents. So, for a few years he adopted a radial flow of steam, and in 1891 had built a condensing turbine. It is interesting to note that Portsmouth Borough purchased a 150 kw radial flow turbo-generator for their electricity supply works in 1893.

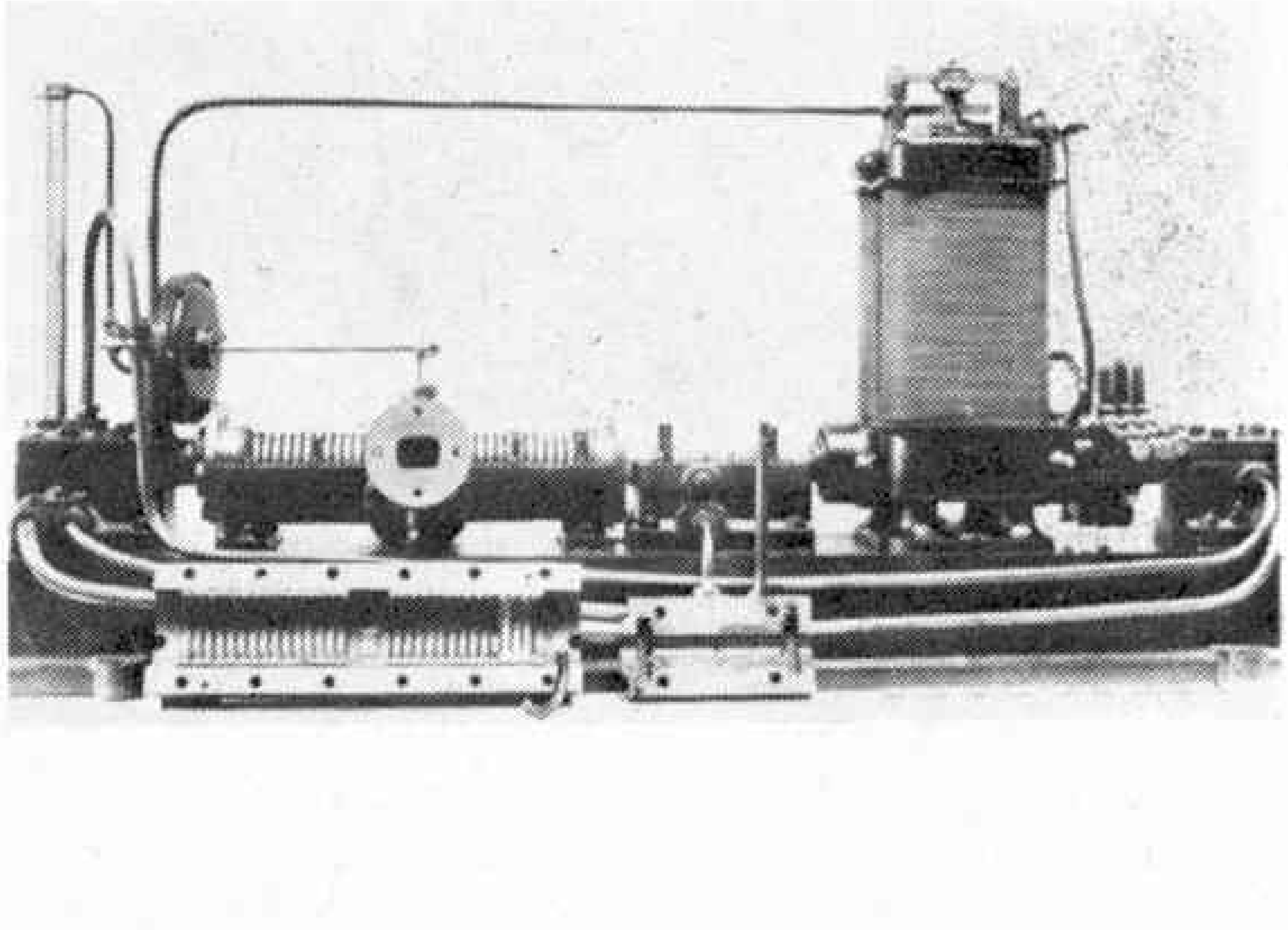
He was able to return to the axial flow principle in 1894, and from then on progress was rapid. A 350 kw machine was supplied to Manchester Square Power Station, London, and by 1923 a 50,000 kw machine had been made. In addition, the machines were being made far more efficient.

In 1893 he formed the Marine Steam Turbine Company for the purpose of adapting the turbine to marine propulsion. After considerable experimental work the S.Y. "Turbinia" was built. She eventually accomplished the then remarkable speed of 34½ knots. Parsons demonstrated the performance of this ship at the Naval Review to celebrate the Diamond Jubilee of Queen Victoria. Arising from this, the Admiralty, after much deliberation, ordered H.M.S. "Viper" to be fitted with turbine machinery. Later H.M.S. "Cobra" was fitted out in the same way.

The first passenger vessel to be equipped with turbine machinery was the "King Edward", and many others soon followed. In 1902 the Royal Navy acquired H.M.S. "Velox" which was turbine driven. H.M.S. "Eden" and H.M.S. "Amethyst" followed. In 1907 the Atlantic liners "Mauretania" and "Lusitania" went into service, the former having turbines developing 70,000 h.p.

But turbine development was not Charles Parsons' only activity. Whilst with Clarke, Chapman & Co., he was active in the manufacture of electric lamps. During 1886 he established his own works for the manufacture of parabolic reflectors for searchlights. In 1921 he turned his attention to optical work, and introduced new methods for melting glass and stirring it when molten. He also possessed an ear for music, and this lead him to invent an instrument which produced sound by controlling the flow of compressed air through a valve, in imitation of the human vocal cords. Another of his interests was that of producing artificial diamonds.

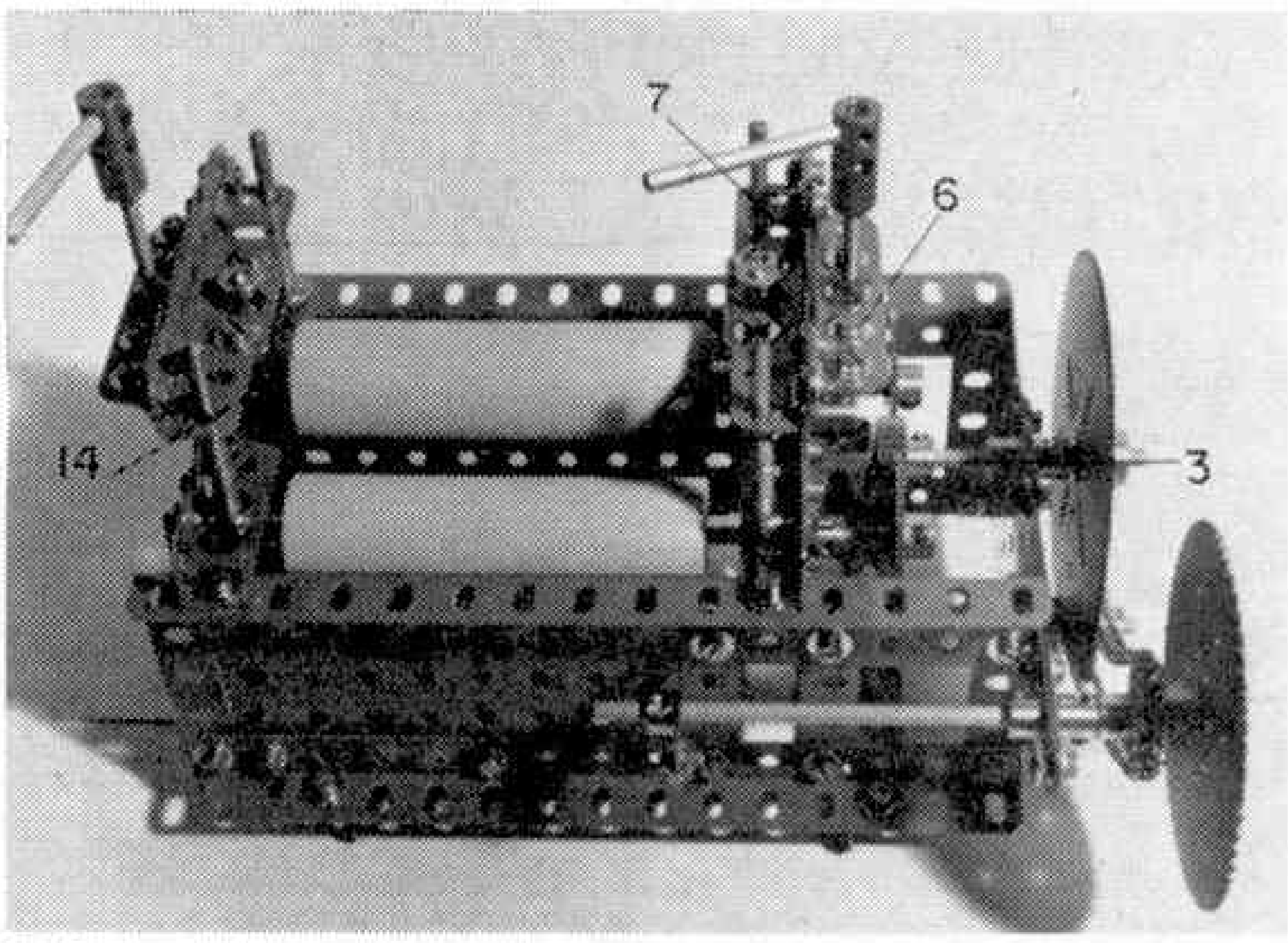
Parsons died on February 11th, 1931, while taking a cruise in the West Indies.



The first Parsons turbo-dynamo constructed in 1884. Photo courtesy C. A. Parsons & Co. Ltd.

AMONG THE MODEL BUILDERS

with Spanner



Built for Meccano Magazine by Mr. Bert Love of Birmingham, this Flexible Plate Bending Machine was originally designed by Ulysse Bachelard of Zurich, Switzerland—a Meccano modeller with some 40 years of model building experience behind him.

THE INTERNATIONAL appeal of Meccano has often been stressed in these pages—so much so, in fact, that some readers are beginning to wonder if I spend my spare time writing copy for advertisements! I assure you I don't, but I make no apology for frequently mentioning the world-wide interest in Meccano, simply because interest in Meccano *is* world-wide. We often hear of enthusiasts outside the U.K. and, in fact, our first offering this month was designed by one such enthusiast—Mr. Ulysse Bachelard of Zurich, Switzerland.

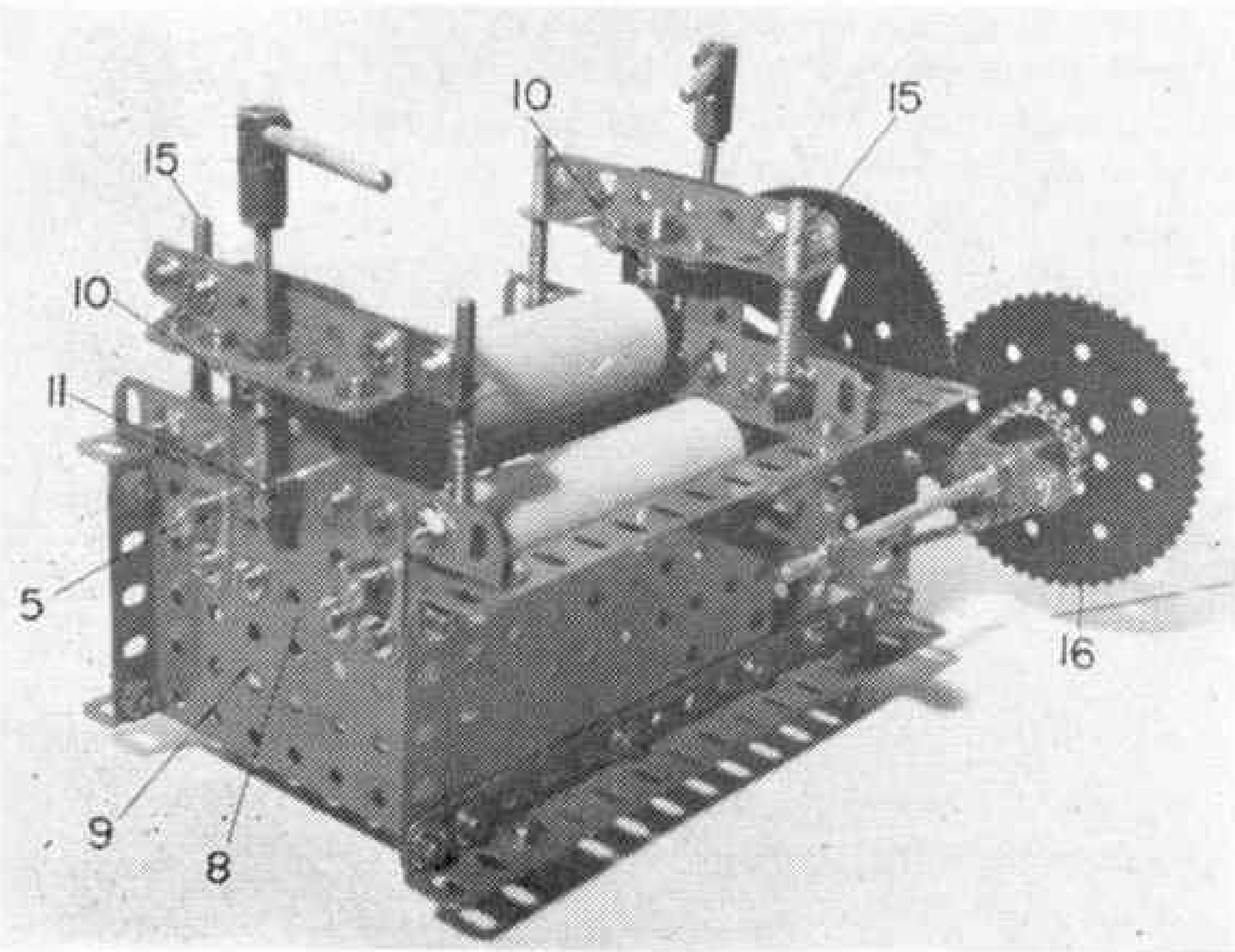
Ulysse has been building models for something like 40 years and I understand that it has been one of his burning ambitions for some time to have something he has designed appear in print. In the past he has been quite unable to attain this ambition as he neither writes nor speaks English, but, on this occasion, he has overcome the problem by sending a photograph of one of his creations to Mr. Bert Love, Secretary of the Midlands Meccano Guild. The model in question was a Flexible Plate Bending Machine which makes an extremely useful tool for a Meccano workshop. Bert Love built a copy of it from the illustration and, with Ulysse's permission, he has written the following description as well as supplying the accompanying photographs.

"The general construction of the framework," says Bert, "is evident from the three accompanying illustrations and consists of four 7½ in. Angle Girders spaced by three 3½ × 2½ in. Flanged Plates. It will be noted that all bearings for Axle Rods are reinforced by Double Arm Cranks to ensure very smooth and positive motion of the bending rollers. A double thickness of 1½ in. Perforated Strips may be substituted for the Cranks if the machine is used on a short term basis.

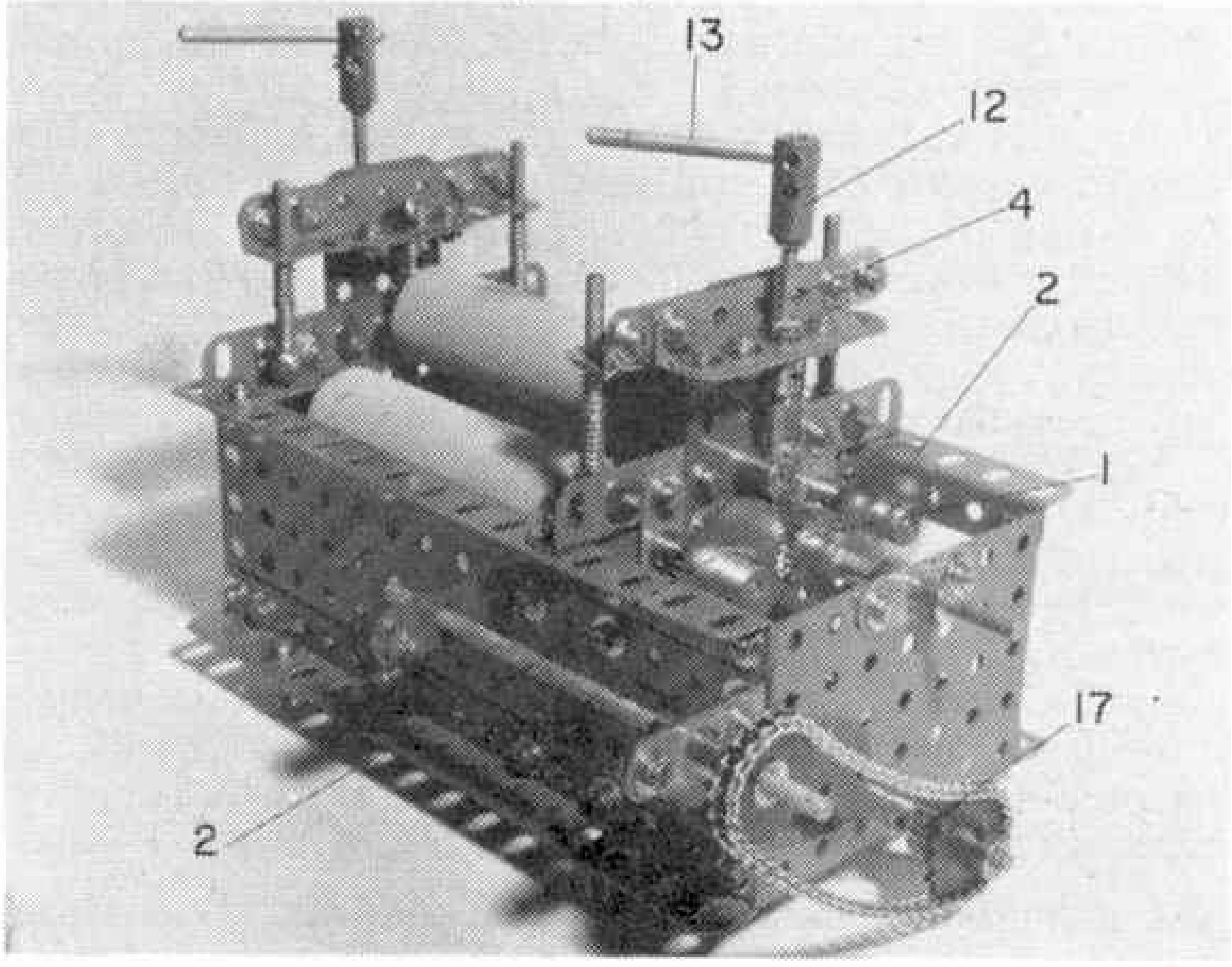
One of the accompanying pictures shows the reduction drive to the lower pair of rollers, both of which rotate in the same direction at the same speed. The ¾ in. Pinion 1 which drives the two 50-teeth Gear Wheels 2 is mounted on a 2½ in. Axle Rod the latter so positioned that only a very small part of it projects through Double Bent Strip 3. This allows clearance for the Screwed Rod 4, used for applying pressure to the top roller, which, like the other two rollers used in the machine, is a standard Meccano Wood Roller covered with a fine grade of sandpaper. This is glued to the Rollers with a few spots of suitable adhesive, the sandpaper being cut carefully to make a neat butt joint and held in place with rubber bands until the glue sets. The lower rollers are carried on 6½ in. Rods 5 kept in place by an inside Collar and a Compression Spring between the face of each 50-teeth Gear Wheel 2 and its adjacent Double Arm Crank. This helps to keep a smooth tension and motion on the Roller shafts and the Springs also act as convenient "Spacers".

Construction of the slides on which the top roller is carried is clearly shown in another photograph. Each slide consists of a 2½ in. Angle Girder 6 bolted to a 3½ in. Angle Girder 7, but spaced from it by a double thickness of Fishplates as shown. This allows the slide to pass freely over the "guide" which is obtained from a 3 × 1½ in. Flat Plate 8 bolted to the Flanged Plate 9 at each end of the Rollers. Both

In this end view of Mr. Bachelard's Machine, construction of the slides for the upper roller is clearly shown.



In this view of the Plate Bending Machine, the built-up crank handle and 3½ in. Gear have been removed to show the reduction gearing to the rollers.



Girders forming each slide carry Double Arm Cranks 10 at their centres, bosses pointing downwards. The boss of the outside Crank provides a journal for one of the 3 in. Screwed Rods 4 used for applying pressure to the top roller. The lower end of each Screwed Rod is inserted into the transverse tapped bore of a Rod Socket 11 as shown. Two lock-nuts are secured about half-way down each Screwed Rod where they bear against a Washer acting as a pressure point applied to the outside of the slide. At their upper ends the Screwed Rods are secured by a lock-nut in the tapped bores of Threaded Couplings 12 in which a 2 in. Rod 13 is fixed to provide a lever.

Loose in the boss of each Crank fixed to the inside Girders of the slides is a 1 in. Rod to the lower end of which a Short Coupling 14 is attached to act as one of the bearings for the top roller. A Collar is fixed on the top of the Rod. Additional guides for the slides are provided by four vertical 2 in. Rods 15 mounted in Handrail Supports. Each of these Rods is fitted with two Compression Springs and Washers to raise the top roller when the pressure screws are released.

The machine is hand driven by a special crank consisting of a 3 in. Sprocket Wheel 16 to which a Long Threaded Pin is fixed. A pair of 1 in. Sprocket Wheels and Chain carry the drive to a ½ in. Pinion 17, as shown, this Pinion meshing with a 3½ in. Gear Wheel mounted on the 2½ in. Rod carrying the Pinion 1.

With this useful machine, Meccano Flexible Plates may be bent to a curvature as small as 1½ in. radius with perfect results. To operate it, a Flexible Plate is placed between the top and the two bottom rollers. Slight pressure from the Screwed Rods is applied and the Plate is rolled backwards and forwards while pressure is continuously applied. Inserting a Plate at an angle will produce a spiral bend, such as used on helter skelters or bus staircases."

PARTS REQUIRED

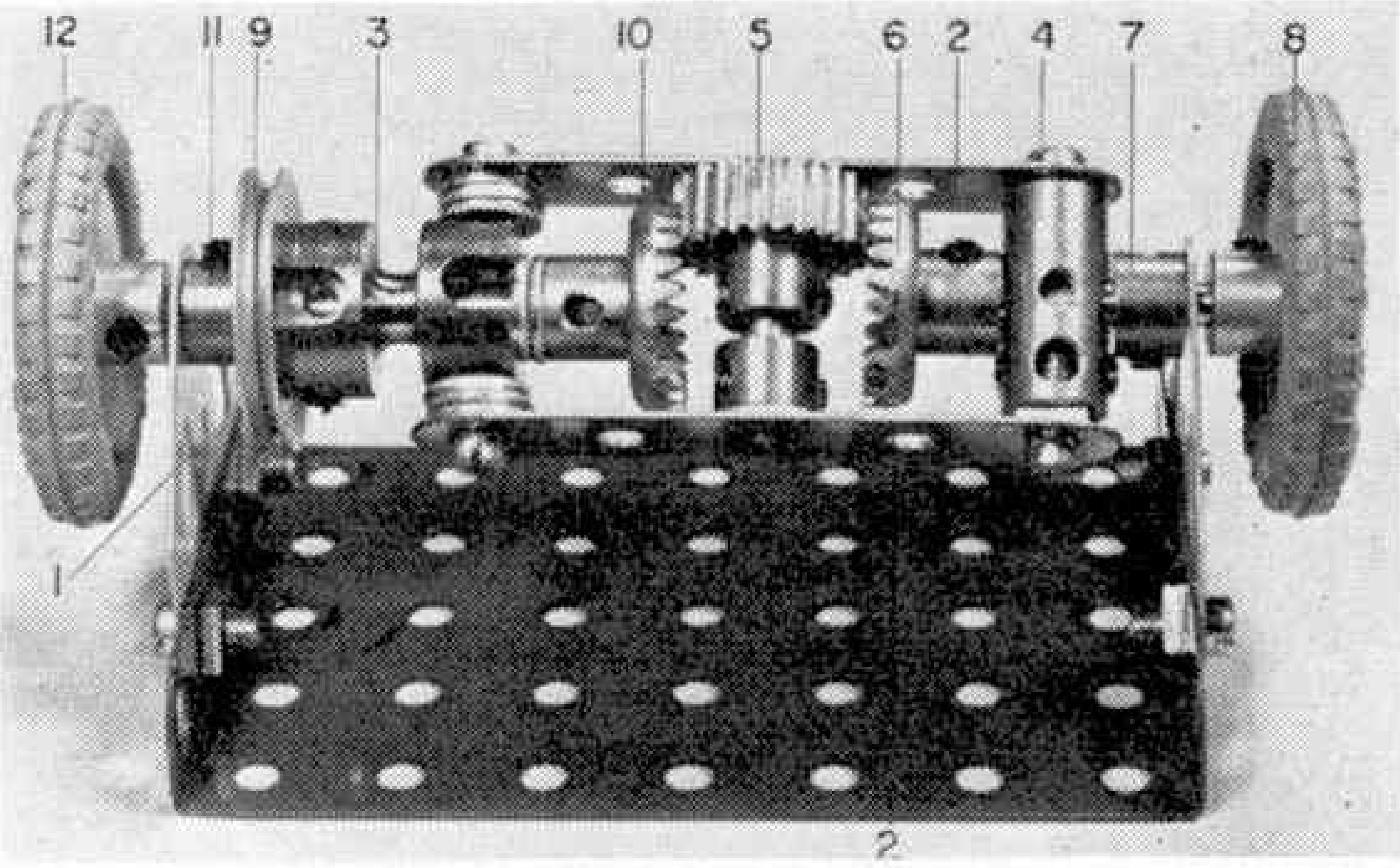
2—5
4—8b
4—9a
2—9b
2—9d
8—10
2—14
1—15
1—16
1—16a
6—17
2—18b
1—25
1—26
2—27
1—27b
80—37
*186—38
1—44
1—47a
3—53
2—53a
6—59
11—62b
2—63c
2—63d
2—73
2—80c
1—94
1—95b
2—96
3—106
1—115a
10—120b
4—136
2—179

Half a sheet of fine grade sand paper.
*** If washers on Nuts and Bolts are omitted, quantity of Part No. 38 is reduced to 26.**

Small Differential

Moving onto a different subject, on two separate occasions during the past year we have featured an extremely interesting mechanism designed by James Grady of Dundee, Scotland. In each case the particular mechanism featured was purposely small in size so that it could be used with small models—especially those using 1 in. Pulleys with Motor Tyres as road wheels. We have already had a Front Wheel Drive system and 4-wheel Independent Suspension from Mr. Grady. Now we have a small Differential Mechanism from the same source, this also being designed for use with 1 in. Pulleys with Motor Tyres.

Construction is not difficult, as the accompanying illustration shows. The mounting will of course vary with the model in which the mechanism is to be incorporated, but, in our example, it consists of a 3½ × 2½ in. Flanged Plate, to each side flange of which a Flat Trunnion 1 is bolted. The apex holes in these Flat Trunnions will later serve as the bearings for the main axle Rods, but first two 2½ in. Strips 2 are secured to a Socket Coupling 3 by ⅜ in. Bolts screwed into the threaded bores at one end of the Socket Coupling, each Strip being spaced from the Coupling by three Washers on the shank of the securing Bolt. At their other ends, Strips 2 are fixed to a Threaded Coupling 4, one by a Bolt screwed into the threaded bore of the Coupling and the other by a ⅜ in. Bolt held by two Grub Screws in the opposite end of the Coupling. A Nut on the shank of this Bolt acts as a spacer. Journalled in the centre holes of Strips 2 is a 1 in. Rod carrying a ¾ in. Pinion 5 and held in place by a Collar.



A simple Differential mechanism designed by James Grady of Dundee for use with small models possibly using 1 in. Pulleys with Motor Tyres as road wheels.

PARTS REQUIRED

2—5
1—17
1—18a
1—18b
3—22
1—25
2—29
5—37a
5—37b
9—38
1—53
3—59
1—63c
3—111c
2—126a
2—142c
1—171

Mounted free in the centre transverse bore of Threaded Coupling 4 and in nearby Flat Trunnion 1 is a 1½ in. Rod on which are fixed a ¾ in. Contrate Wheel 6, a Collar 7 and a 1 in. Pulley with Motor Tyre 8. Contrate 6 is in constant mesh with Pinion 5.

A 1 in. Pulley with boss 9 is now fixed in the outside end of Socket Coupling 3. Journalled free in this and in the Socket Coupling, as well as in appropriate Flat Trunnion 1, is a 2 in. Rod carrying a second ¾ in. Contrate Wheel 10, spaced from the Socket Coupling by two Washers, a Collar 11 and another 1 in. Pulley with Motor Tyre 12. Contrate 10 also meshes with Pinion 5, Pulleys with Tyres 8 and 12 act as the road wheels, while the drive, in this case supplied by a Driving Band, would be taken to Pulley 9. This Pulley, by the way, could be replaced by another part such as a Sprocket Wheel, if required.

I would like to close this month by drawing your attention to the illustrations on page 162. They show the work of two really keen Meccano enthusiasts, one in this country and the other across the far side of the world, in Australia. Neither of these gentlemen, Mr. D. G. Higginson of Stevenage, Herts., here, and Mr. W. R. Inglis of South Blackburn, Victoria in Australia, court annonymity. On the contrary they are both very active in making the public aware of Meccano and showing the " uninitiated " something of what can be done with the system—and this in the best way possible, by exhibiting well-built and detailed models. The photographs, in fact, show Mr. Higginson and Mr. Inglis with their models on show, the former at a recent exhibition he gave in a Stevenage school,

Continued on page 162

NEW FIRE FIGHTING DEVICES

by D. Rothwell

The Simon Snorkel would make an excellent subject for a working Meccano model. A free Meccano Magazine subscription for the first photograph of a completed working model sent to the Editor.

EVER SINCE the Fire Service was formed, the only way of tackling a fire above ground level or rescuing people, has been to use a ladder of one kind or another. In the early years, these were made of wood and were so short that they were only of limited use. Over the years, although still constructed of wood, ladders became more sophisticated and the introduction of the extending ladder enabled greater heights to be reached, although of course this meant a considerable increase in weight.

The introduction of the alloy metal ladder, with its comparative lightness and increased strength, was a big step forward, and it is this type of ladder that is used in the modern Fire Service of today. Although today's ladders are capable of extending up to 100 ft. or more, they have their limitations. A ladder only has room for one fireman to stand at the top, and rescue operations can be very tricky. It is very difficult to get from a ladder into a building to rescue people who may be very frightened or even unconscious. The only means of moving a ladder (even one mounted on a turntable), is from the ground, and a fireman at the top of a ladder, possibly enveloped in smoke and surrounded by the noise of burning timber, wishing to have the ladder moved, could have difficulty in conveying to the man on the ground the exact position in which he would like the ladder to be.

To overcome this problem, and others, a truly remarkable device, known as the "Simon Snorkel" has been developed. You have probably seen similar versions of this vehicle carrying out repairs to street lights in your town. They are widely used by Local Councils and Electricity Boards for work of this nature; although compared with the sophisticated version used by the Brigade, they are rather crude.

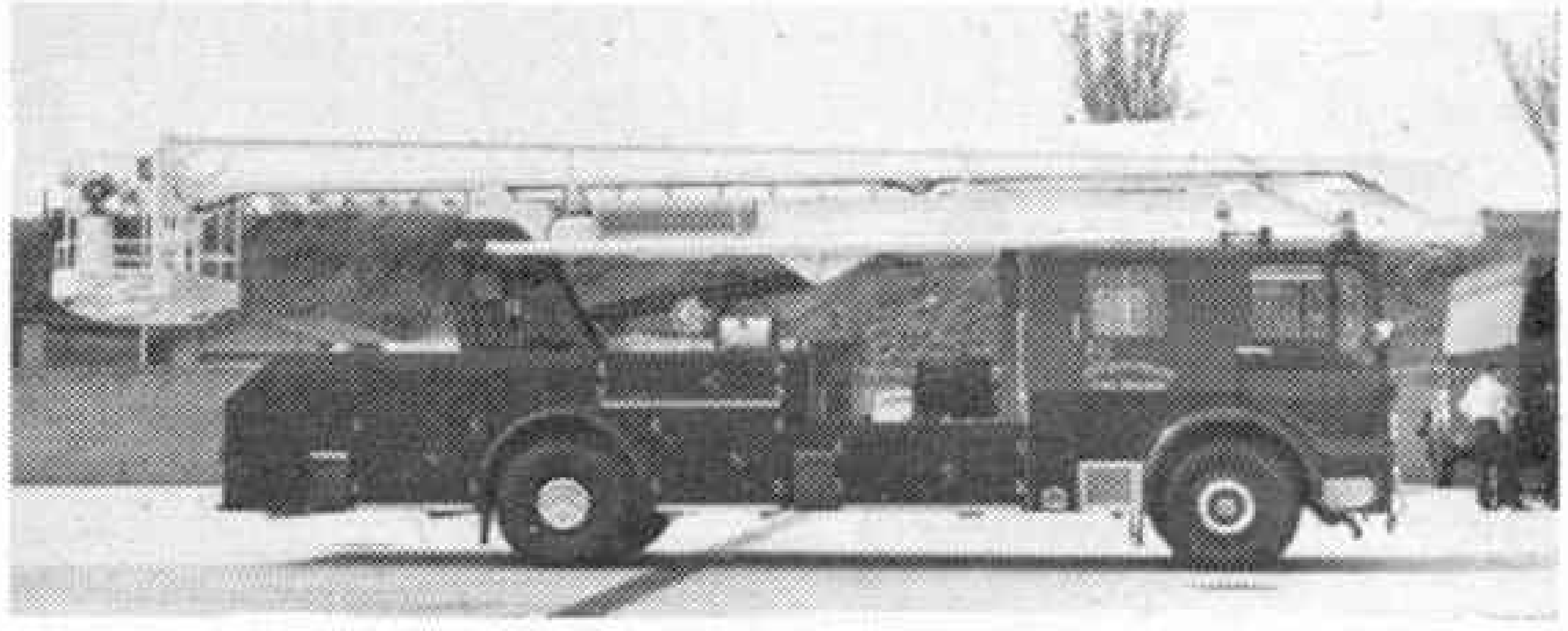
The Simon Snorkel was designed to carry out the duties normally performed by (a) turntable ladder; (b) pump escape; (c) pump, and (d) foam tender. The vehicle about to be described should provide a very interesting challenge to Meccano model builders, as it has a number of working parts which should give would-be builders a real challenge.

Basically, the Snorkel consists of an articulated boom assembly, carrying at its upper end a large "cage". The booms are pivoted on a turntable, which is capable of continuous rotation in either direction. Operation is completely hydraulic, power being taken from the vehicle's engine, or in some cases, by a separate unit. The lower boom is 25 ft. long, while the upper boom is 32 ft. 6 in. The cage is of tubular steel construction with a perforated metal floor. It is of the "underslung" type, pivoted to the boom at waist level, to keep the height when in the fully lowered travelling position, to a minimum.

It is held level at all times during operation by a dual-automatic, parallelogram, levelling system of square section tubes. With a floor area of 14 sq. ft. it has ample room for six adults.

Controls for the operation of the Snorkel are duplicated. The fireman in the cage can move the unit in any direction he chooses, or the Officer in charge on the ground, can carry out the operations. This "doubling up" of the controls has an obvious advantage. The man in the cage has at times, a better picture of the building than anyone on the ground, whose vision may be obscured by smoke and flames, and should the unit be used for rescue purposes, it can be sent up empty, thus leaving space for one more person in the cage. The Snorkel is so versatile that it can be driven through a window and landed on the floor of a room! A two-way radio system enables instructions to be given either from cage to ground, or ground to cage.

As a fire-fighting unit, the Snorkel has some pretty impressive equipment. The whole of the cage can be



Our heading photo shows two trainee firemen being instructed in the use of the monitor on the Simon Snorkel. At left: The latest multi-purpose fire appliance. Above: Note the immense amount of locker space on the Simon Snorkel. This would make an ideal subject for a Meccano model with its very clean lines.

shrouded in a water spray at the rate of 100 gallons per minute, protecting any occupants against severe heat or flames. A large "monitor" (water outlet nozzle) rather like a cannon, is mounted at the front of the cage, which has 60° rotation, 70° elevation and 60° depression. The monitor can deliver 600 gallons per minute at a pressure of 100 lb. per square inch. By twisting the nozzle on the monitor the water can be changed from a jet to a spray.

An air compressor, mounted on the fire engine can supply fresh air to three masks for the persons in the cage, which enables them to breathe in smoke, etc. An electrical lead in the cage can supply power for searchlights, cutting tools, foam generation or smoke extractors!

Ladders are fitted to enable personnel to climb from ground level to cage if operational conditions make it undesirable for the unit to be moved.

Before the Snorkel can be used, the vehicle must be stabilized. Four huge hydraulic jacks are lowered to provide an absolutely steady base on which to commence operations. These are controlled by small levers situated on the back platform of the vehicle. The large number of lockers down each side of the vehicle contain an amazing assortment of tools and equipment for use in any type of emergency. Small hoses on reels are also fitted, enabling Firemen to tackle minor fires at ground level. Below is a list of information for the technically minded:

Full stroke of upper boom—50 secs.; full stroke of lower boom—50 secs.; 360° rotation (either direction) —120 secs.; time to extend each jack—11 secs.; time to extend all jacks—20 secs.

The monitor can withstand a reaction of 1,000 gallons per minute at 100 pounds per square inch pressure in any direction. The cost of the whole unit, including the Leyland chassis is £18,000.

Built once again on a Leyland chassis is another new type of Fire Engine. Not as revolutionary as the Simon Snorkel, but in its own way just as new and versatile, is the latest "Multi Purpose" vehicle. This machine was designed and constructed to perform the types of duties normally carried out by the following four machines (a) pump; (b) pump escape; (c) water tender, and (d) foam tender.

The chassis of the vehicle is shorter than the Snorkel, although it is powered by the same engine, and has power assisted steering and brakes.

The pump on this vehicle delivers 600 g.p.m. at 100 p.s.i. when pumping from a pond or lake, 10 ft. below the level of the machine. It carries 400 gallons of water in a large tank, and has two hosereels coupled to four 60 ft. lengths of high pressure hose with "fog-gun" branchpipes. These guns, incidentally, are rather cunning pieces of equipment, shaped rather like "Tommy-guns". Pulling the trigger releases the water and a twist of the handle changes the water from a jet to a spray. Its tank can supply water for 2 minutes, when all the hoses, etc. are being used.

This machine carries 4 ladders: a 46 ft. 4 ins. light alloy extension ladder; a 35 ft. timber extension ladder; a 14 ft. light alloy extension ladder; and a 15 ft. 3 ins. timber roof ladder. Also carried is a portable petrol driven pump, which can pump at a rate of 200 g.p.m. An immense number of tools are also carried. In one locker alone the following list of items are to be found: 2 chisels—1 floor saw—1 hacksaw with 3 spare blades —1 gemmy—5 lift keys—1 lump hammer—1 masons hammer—1 pair of pliers—1 adjustable spanner—2 doubled ended spanners—2 ring keys—1 pair of stilson wrenches—3 screwdrivers—3 Phillips screwdrivers—1 pair of wire cutters.

Above: The large lettering on the rear of the Simon Snorkel are in white reflective tape. Below: With the jacks down the cage is lowered to receive the firemen.

CLASSIFIED ADVERTISEMENTS

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Box numbers count as six words when costing the advertisement. When addresses are included, these are chargeable at the same rate (4d. or 8d.) per word as the remainder of the advertisement. Copy and box number replies should be sent to the Classified Advertisement Department, MECCANO Magazine, 13-35 Bridge Street, Hemel Hempstead, Herts. Latest copy date for insertion in the April issue is Feb. 6th

WANTED

Hornby or Bassett-Lowke, etc., gauge O trains wanted by private model railway enthusiast.—Box No. 25 (Surrey), "Meccano" Offices, Hemel Hempstead, Herts. OPQ

Wanted. Mint and boxed "Matchboxes": 39 Ford Convertible, 47 Trojan, Y8 Morris, 33 Zodiac. State price.—Ralston, 49 Strathmore Ave, Paisley. O

Pre-war and Early Post-war Dinkys, Tootsietoys, Minics, etc. High prices paid.—D. Pinnock, 10 Hurstville Drive, Waterlooville, Hants. Tel: 2958 (evenings). N-X

Model Cars of all sorts wanted. Good prices (or exchange) for early die-cast models, tinplate toys, obsolete kits, etc., which will be incorporated in a permanent display.—Dr. Gibson, The Green, Anstey, Leicester. G-R

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Wanted. Pre-war O gauge Hornby locomotives, trucks, coaches, track, accessories. Best prices paid. State models available.—6 Pascall, 10 Clochbar Avenue, Milngavie, by Glasgow, Scotland. O

Collector Seeks obsolete Dinky buses and military equipment. Write—P. W. Ross, 4 Chelford Road, Manchester, M16 OBJ. OPQ

P/N 119. I will shortly be manufacturing some perfect replica's of Meccano Channel Segments—improved pattern. Cost will not exceed $8.00 (Aust.) per set of 8 including postage. To reserve your requirements write immediately. Do not send money until advised I am ready to supply.—W. R. Inglis, 219 Blackburn Road, South Blackburn, 3130, Victoria, Australia.

Wanted. Large coloured plastic kit of liner "France," also Tri-ang green "Princess Elizabeth," locomotive and tender, complete box, in good condition state prices.—Box No. 23 (Yorkshire,) "Meccano" Offices, Hemel Hempstead Herts. O

Pre-war O Gauge locomotives, rolling stock and track. Damaged models considered if suitable for spares. Details and price required please.—Duroure, 27 Great Eastern Road, Hockley, Essex. O

All Types Dinky military vehicles and warplanes, both pre-war and post-war, urgently required by collector. Good prices paid. Write details, prices.—A. Sinnott, 59 Auckland Road, Doncaster, Yorks. O

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F-L, Standard Mechanisms, other pre-1939 Manuals, pre-1955 Manuals, pre-1939 M.M.'s, pre-1958 Corgis, Kitmaster kits, post-war Minics. Most mint. Offers. S.A.E. for list.—8 Park Lane, Pickmere, Knutsford. O

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UFO Detector Circuits, data, 10s. (refundable).—Paraphysical Laboratory (UFO Observatory), Downton, Wilts. O

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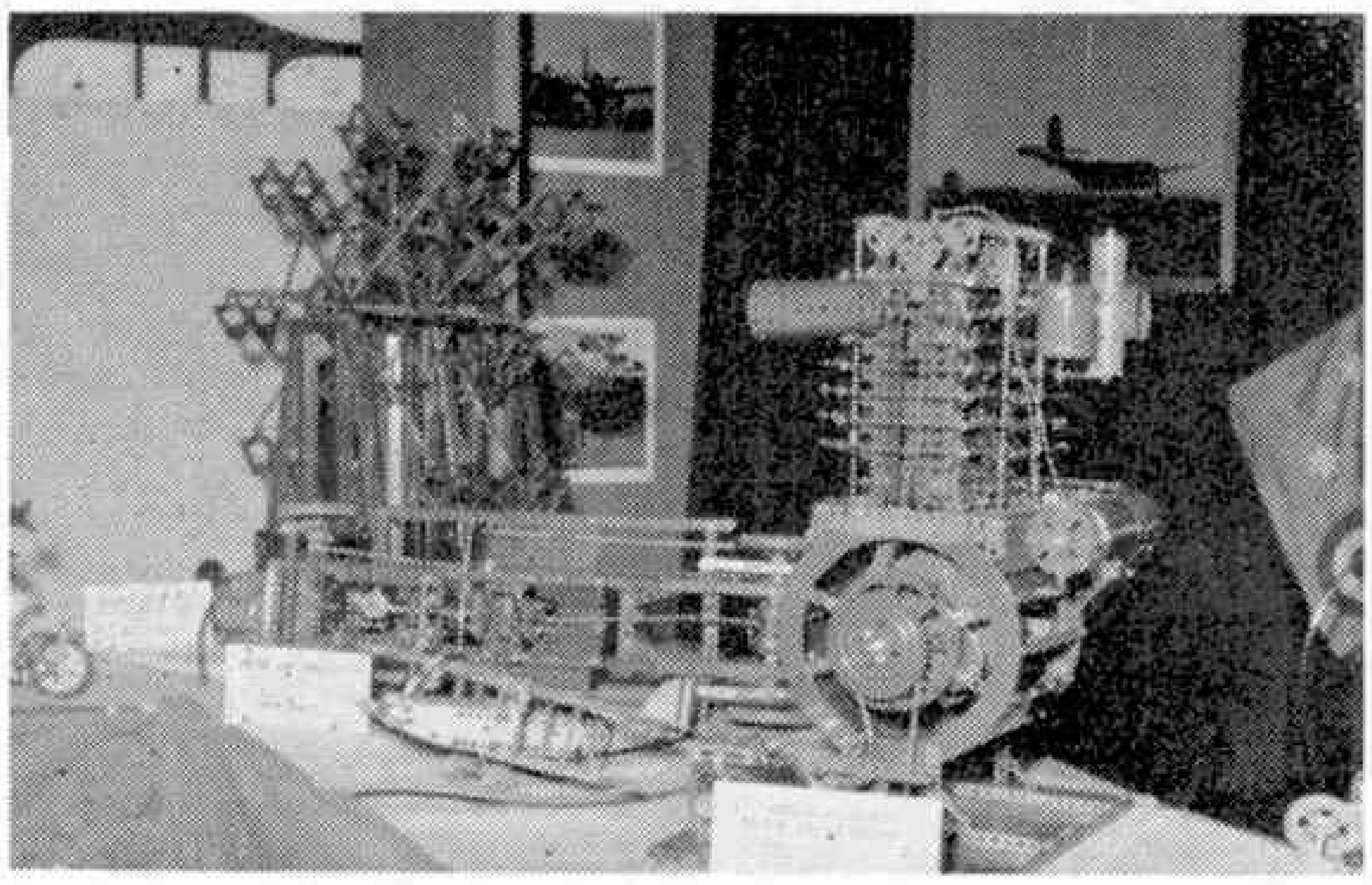
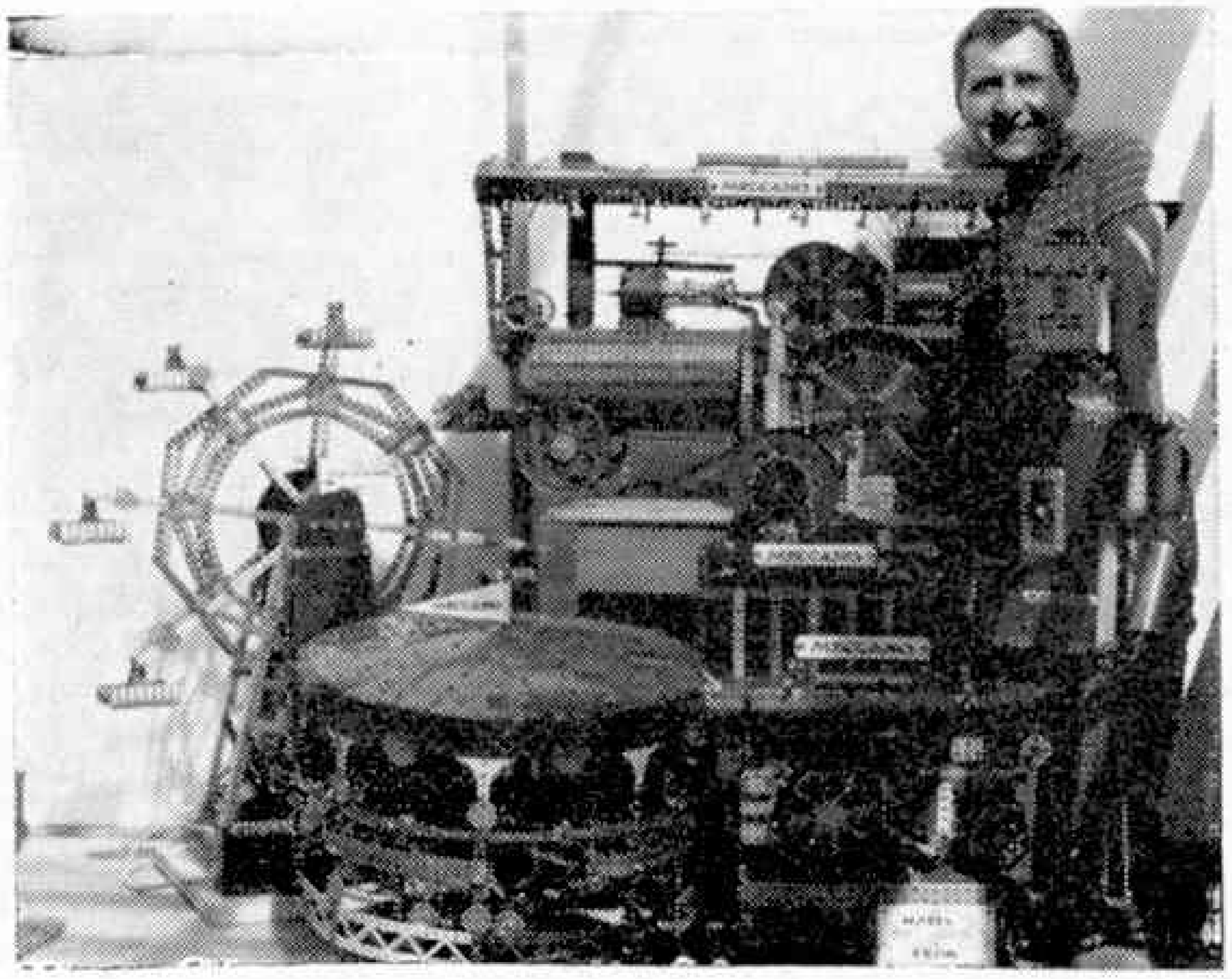
Among the Model Builders

Continued from page 157

and the latter on his own stand at the 1968 Nunawading Arts Festival held in October last year. Mr. Inglis's stand was reckoned to be first class, and Mr. Inglis, himself, wrote that he thought it "amazed present-day children who had never seen anything like it and did not realise what can be done with Meccano—more is the pity, as it is a wonderful hobby."

Below left: Some of Mr. Inglis's models as they appeared on display at the Australian Nunawading Arts Festival. The small aircraft in the foreground is built with the Meccano pre-war No. 2 Aeroplane Constructor Outfit. Below: Another reader who is keen on showing his models is D. G. Higginson of Stevenage, Herts. This picture shows him with some of the first-rate constructions he was presenting at an exhibition he gave recently at a Stevenage school.





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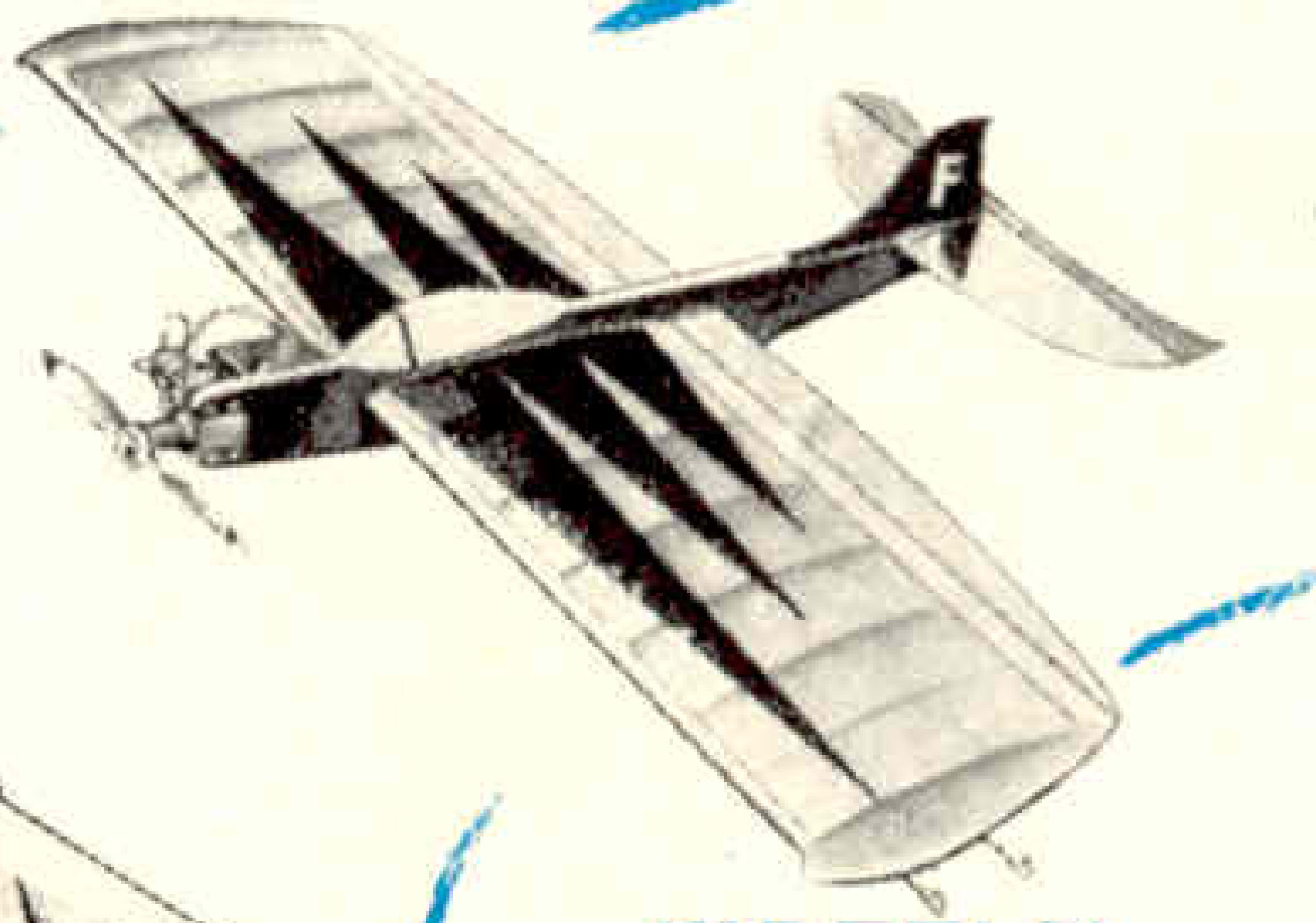

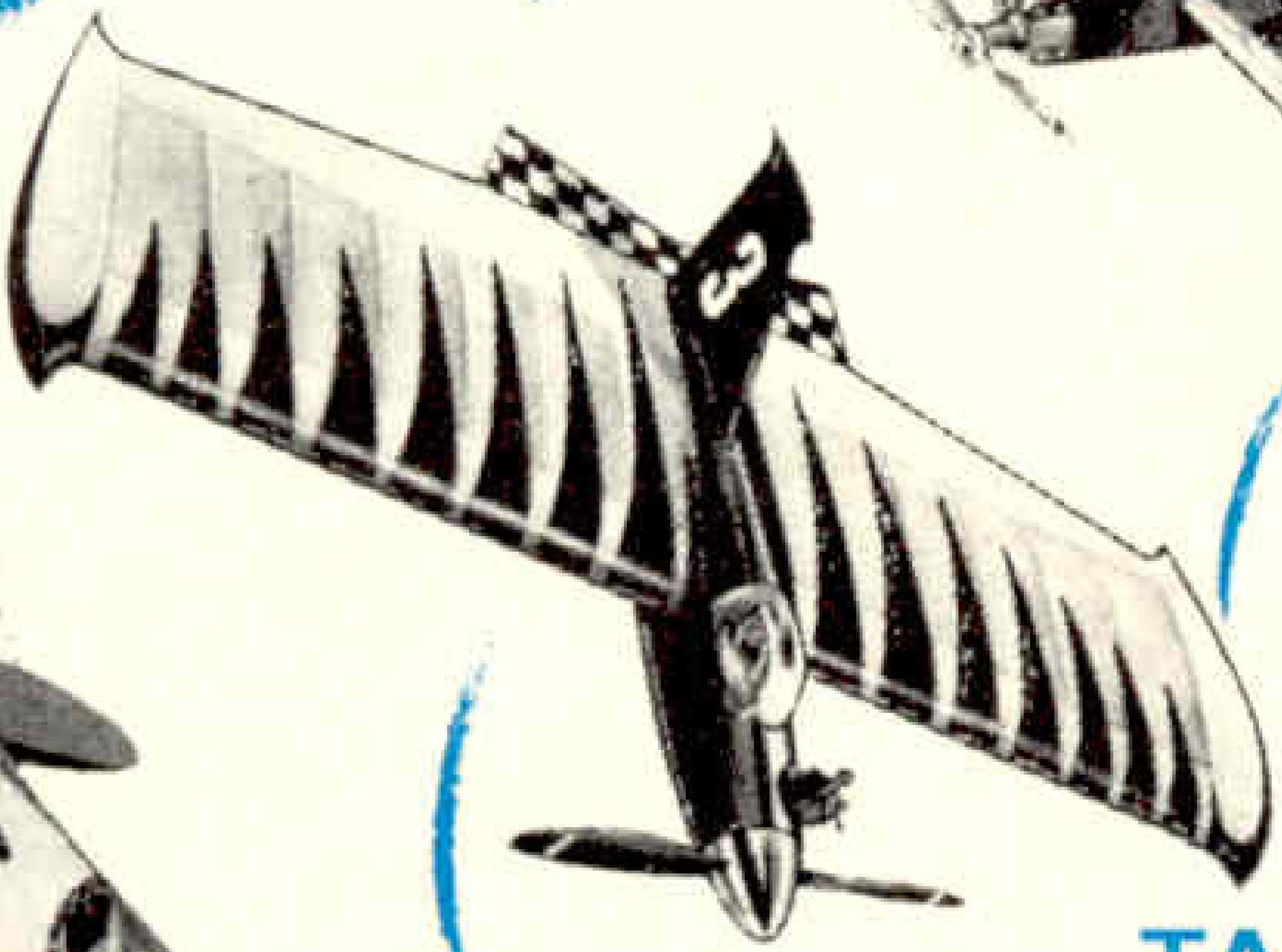

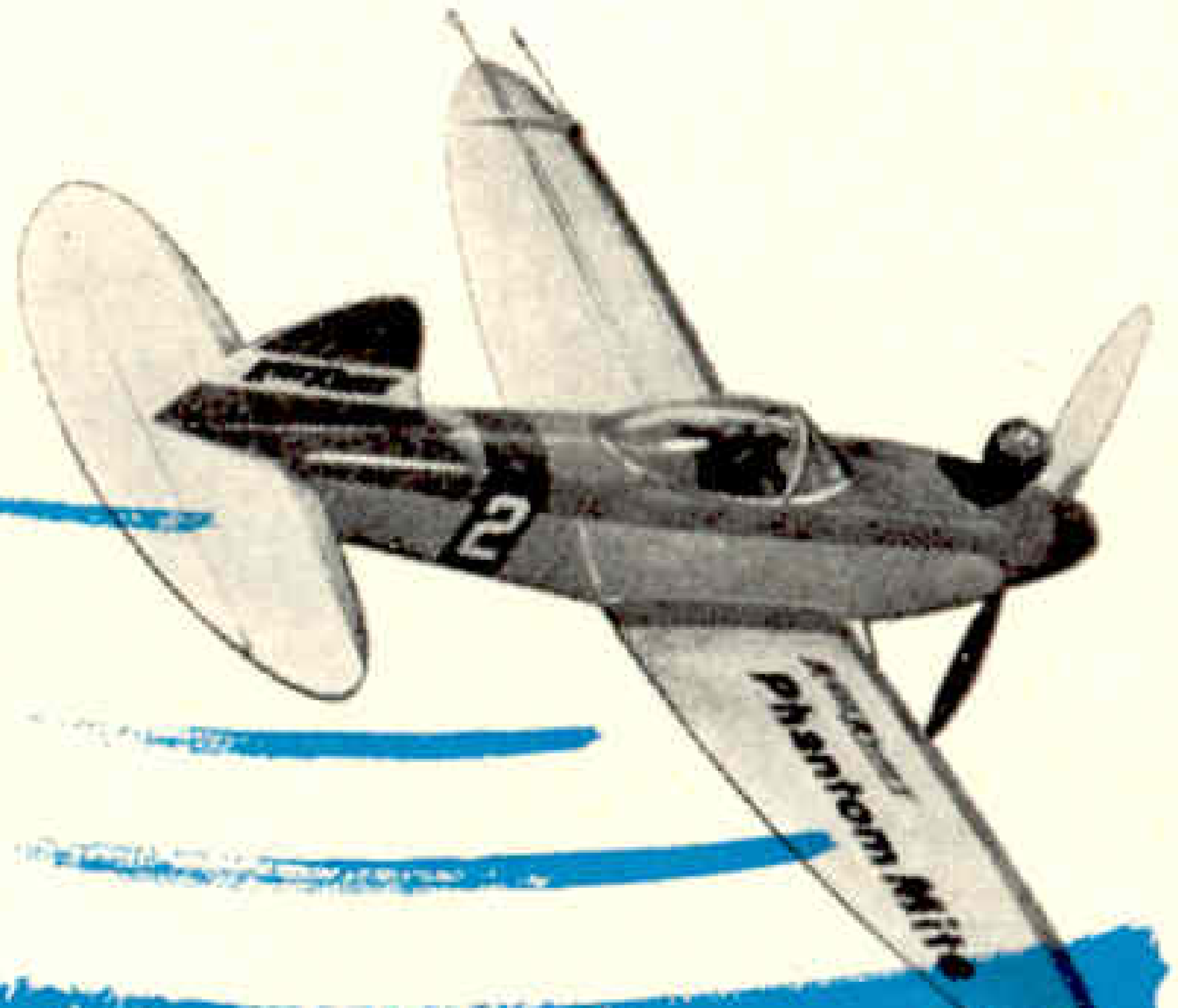

FIREFLY

Stunt model with "profile" type fuselage. Specially designed for engines under 1 c.c. Kit contains die-cut parts. Wingspan 20".

25/7

MARQUIS

A very fine looking stunt model with attractive semi-scale lines, featuring tricycle undercarriage and extra large cockpit. For 1 to 1.5 c.c. engines. Wingspan 30".

50/4

TALON

Combat design of considerable strength. Easy and quick to build. A fully aerobatic model that is great fun to fly. For 2.5 to 3.5 c.c. engines. Wingspan 32".

39/4

DEMON

Class A team racer to S.M.A.E. specification Kit contains die-cut parts. For engines up to 2.5 c.c. Wingspan 30".

46/7

RADIAN stunt model with coupled wing flaps and elevators

The latest thing small stunt controliners for 049 motors. Kit contents include die-cut parts, stunt tank, preformed U/C, formed canopy, all hardware, full size plan and instructions. 22" wingspan.

27/4

PHANTOM MITE

The Phantom Mite is just about the toughest mode available to the newcomer to control line flying. Features all sheet construction with wings, tailplane, fin and fuselage sides ready to cut to shape. For .5 to .8 c.c. Wingspan 16".

22/11

IDEAL FOR THE NOVICE

SPECTRE

Outstanding stunt model featuring combined wing flap and elevator control. Wing ribs, formers, etc., die-cut in highest quality balsa. For 2.5 to 3.5c.c. engines. Wingspan 41".

59/1

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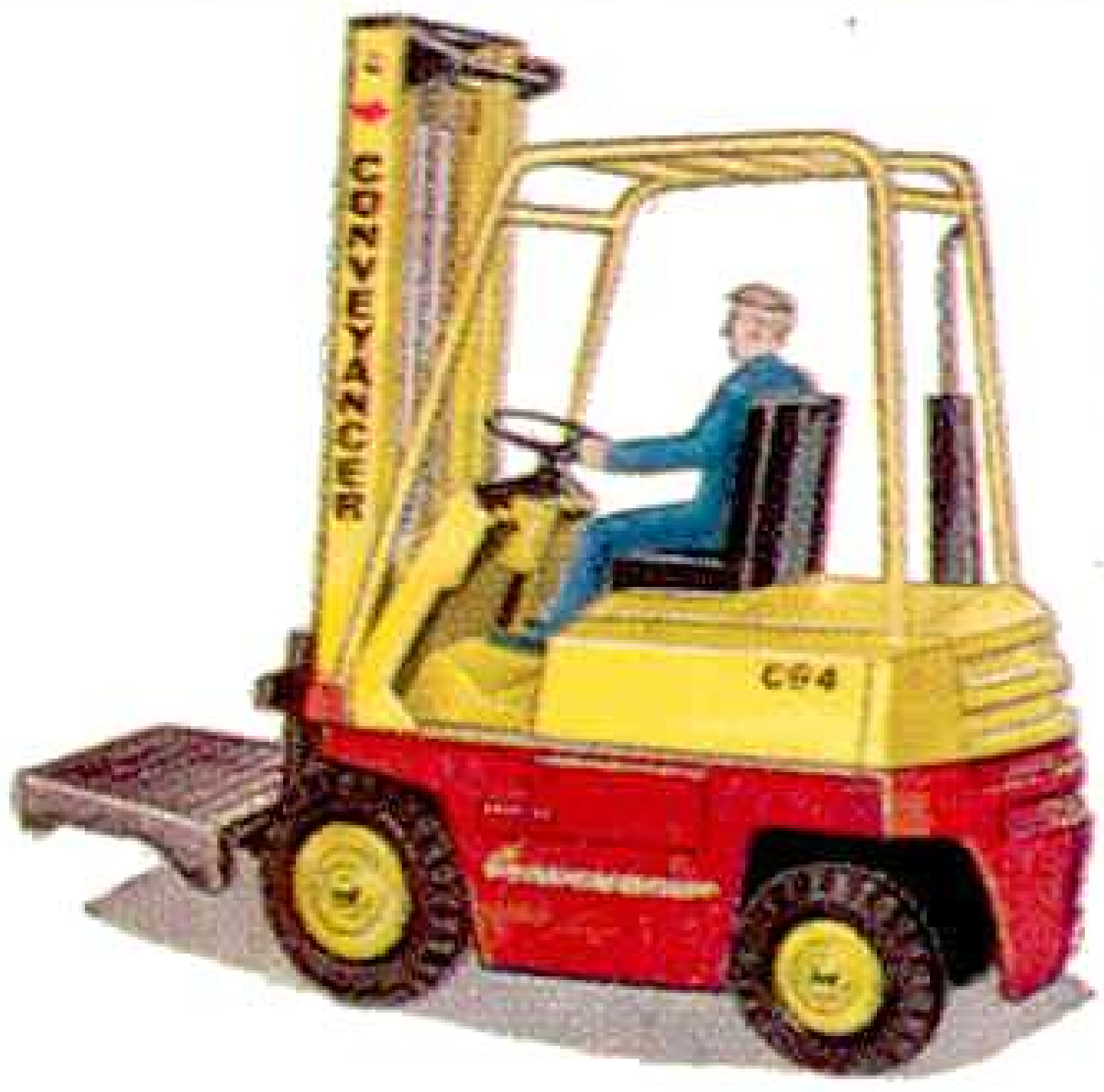
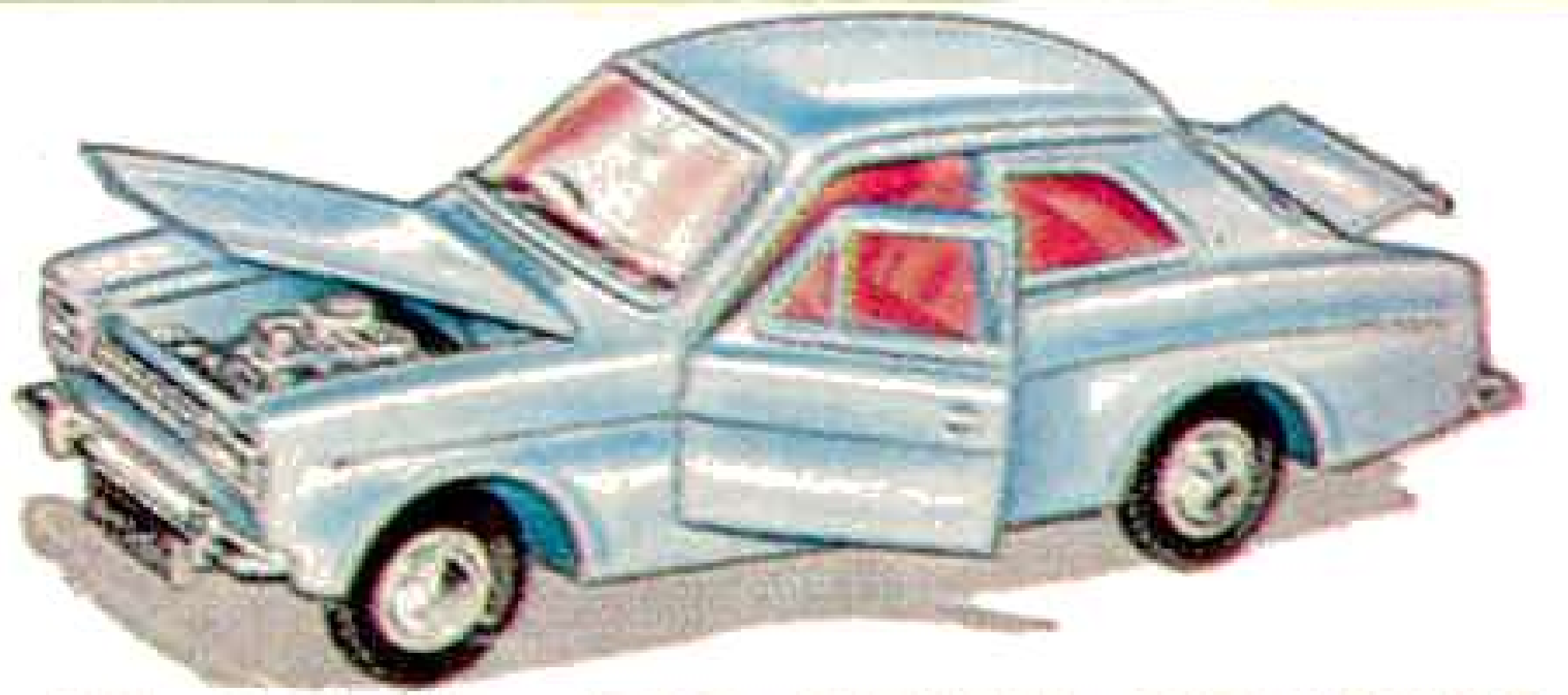


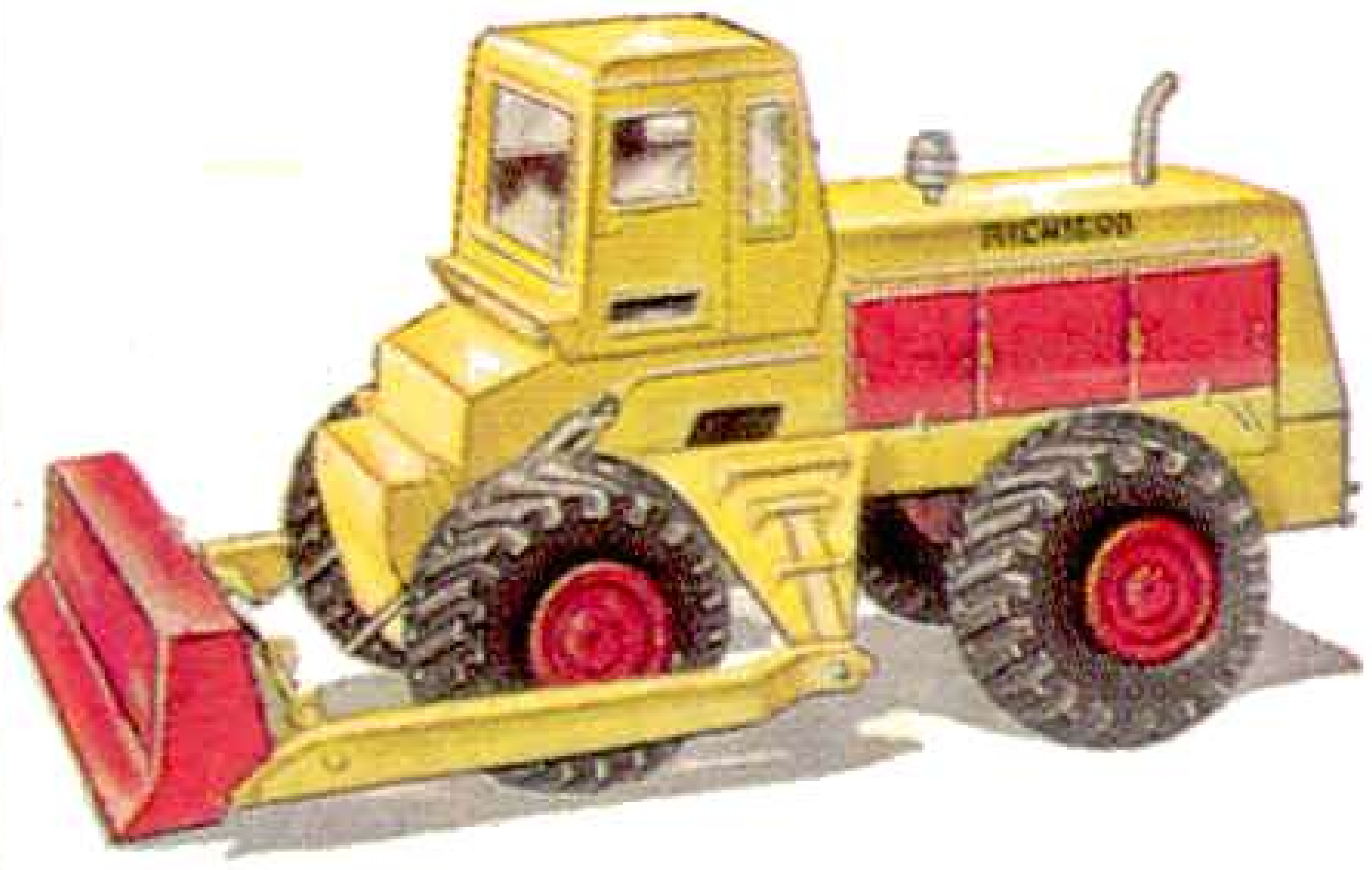
Model No. 404 CONVEYANCER FORK LIFT TRUCK

Raising and lowering fork blades with pallet. Steering. Removable Load Guard and Driver. Lifting engine cover. Detailed engine. Height 3$\frac{3}{8}$". Length 3$\frac{13}{16}$".



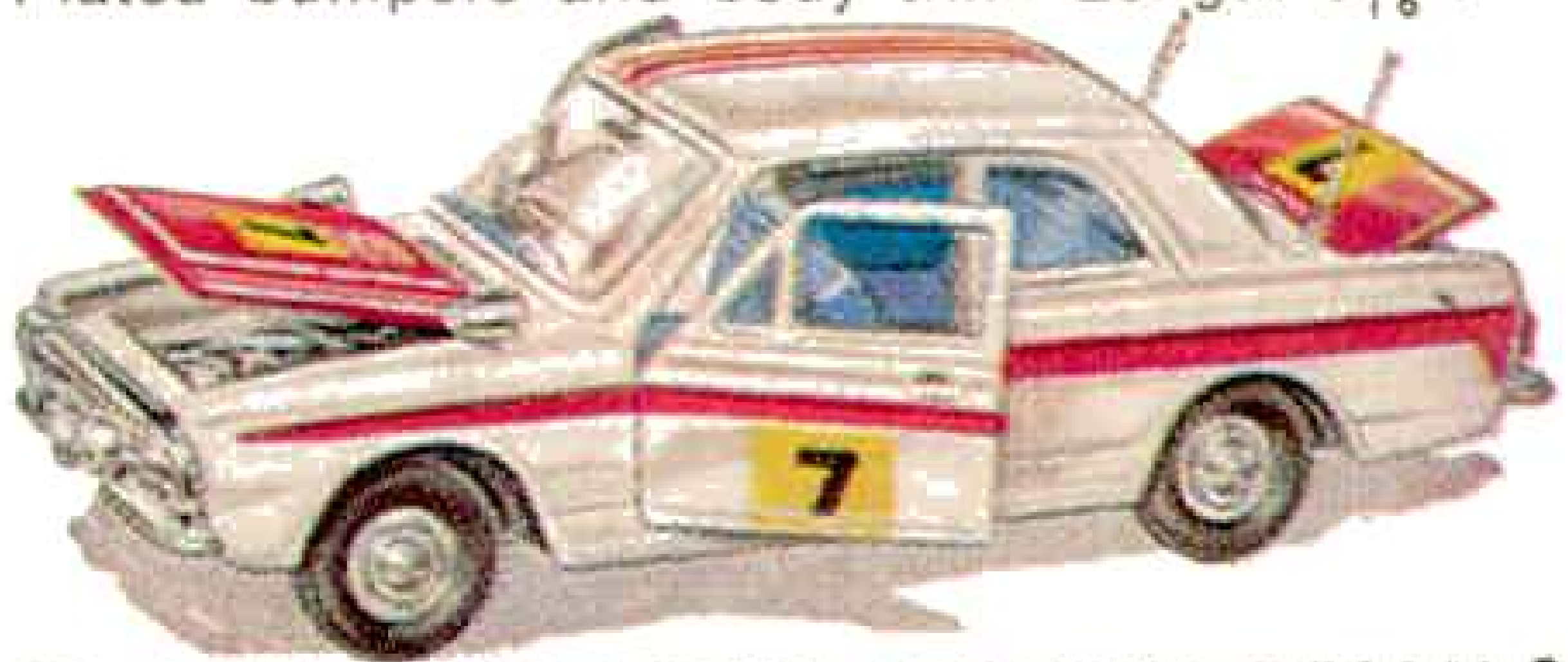
Model No. 168 FORD ESCORT

Opening bonnet and boot. Detailed engine. Opening doors. Moulded seat interior with tip up front seats. Plated bumpers and body trim. Length 3$\frac{13}{16}$".



Model No. 976 MICHIGAN 180-111 TRACTOR DOZER

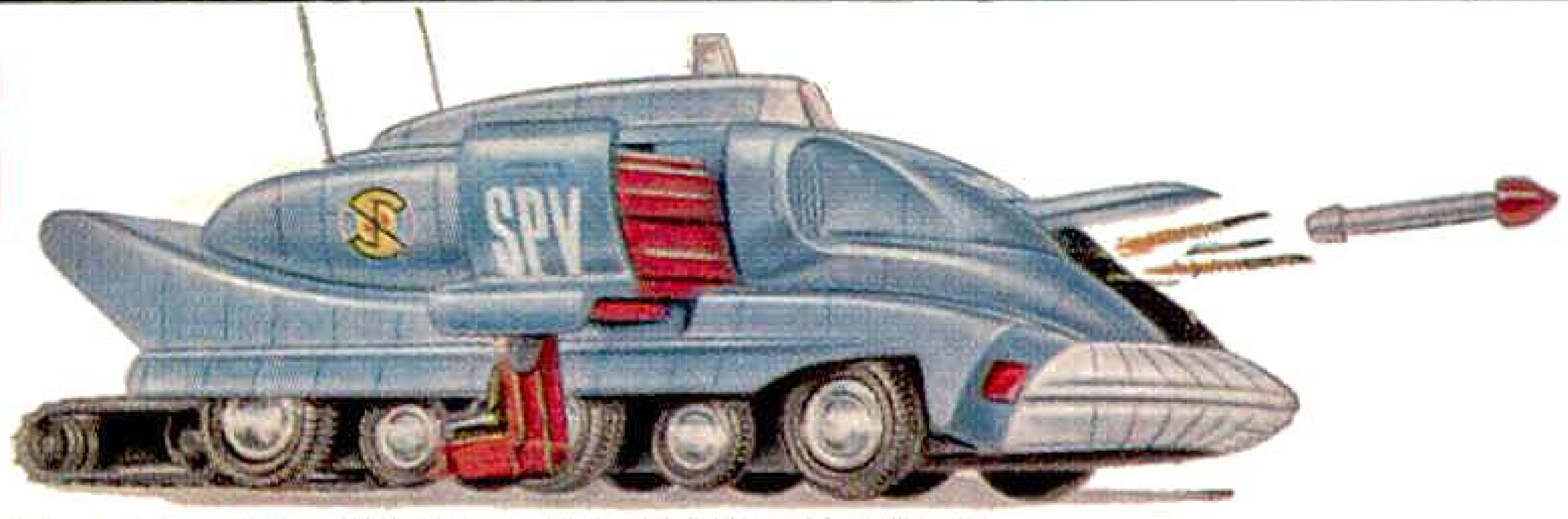
Detachable cab. Lift-off engine panels. Lifting arms. Tilting blade. Steers from cab. Length 5$\frac{3}{4}$".



Model No. 205 LOTUS CORTINA RALLY CAR

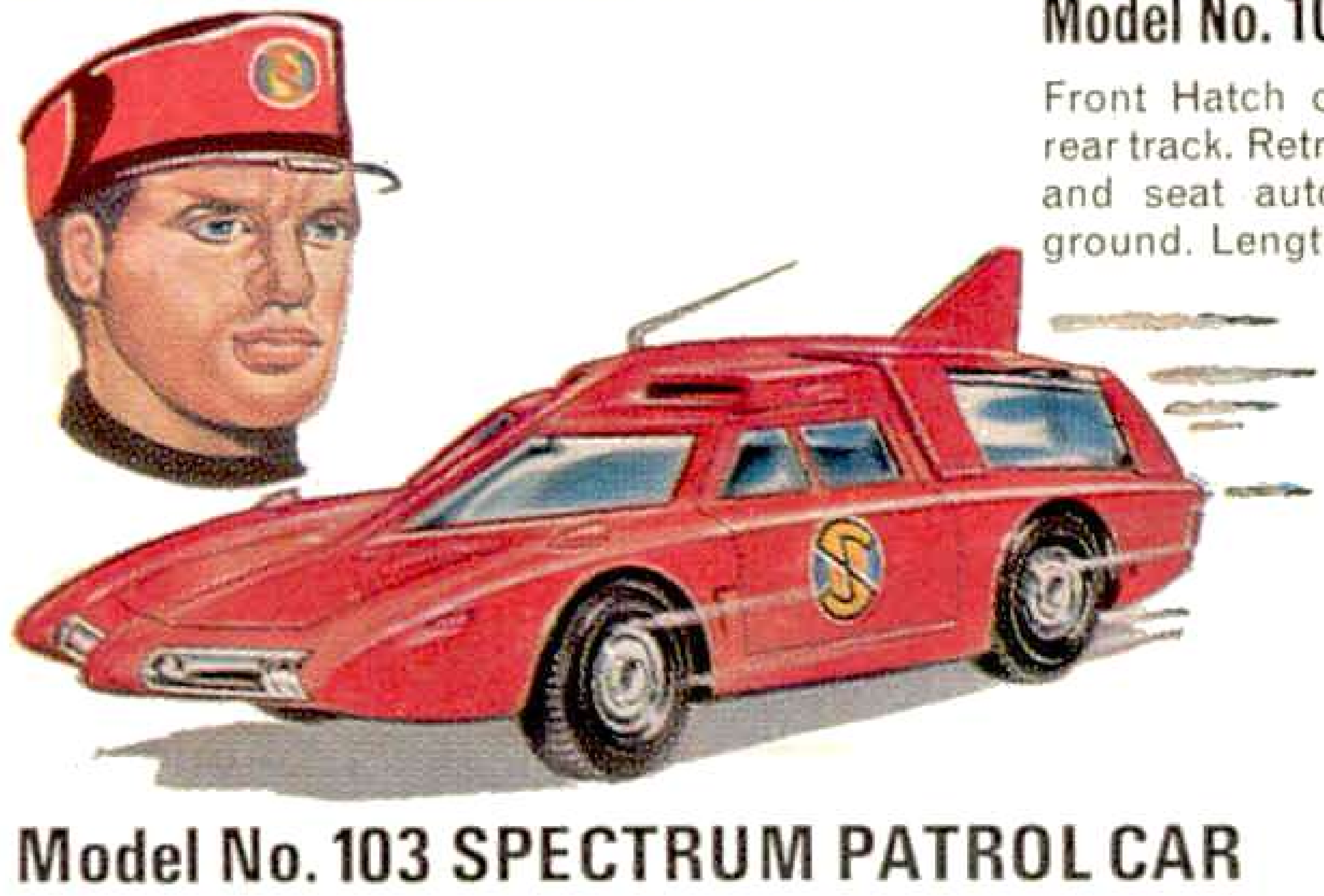
Opening bonnet with special release. Opening boot and doors. Tipping front seat backs. Plated bumpers and grille. Triple spot lights. Racing type wing mirrors. Twin aerials. Rally numbers and body flashes. Length 4$\frac{1}{8}$".

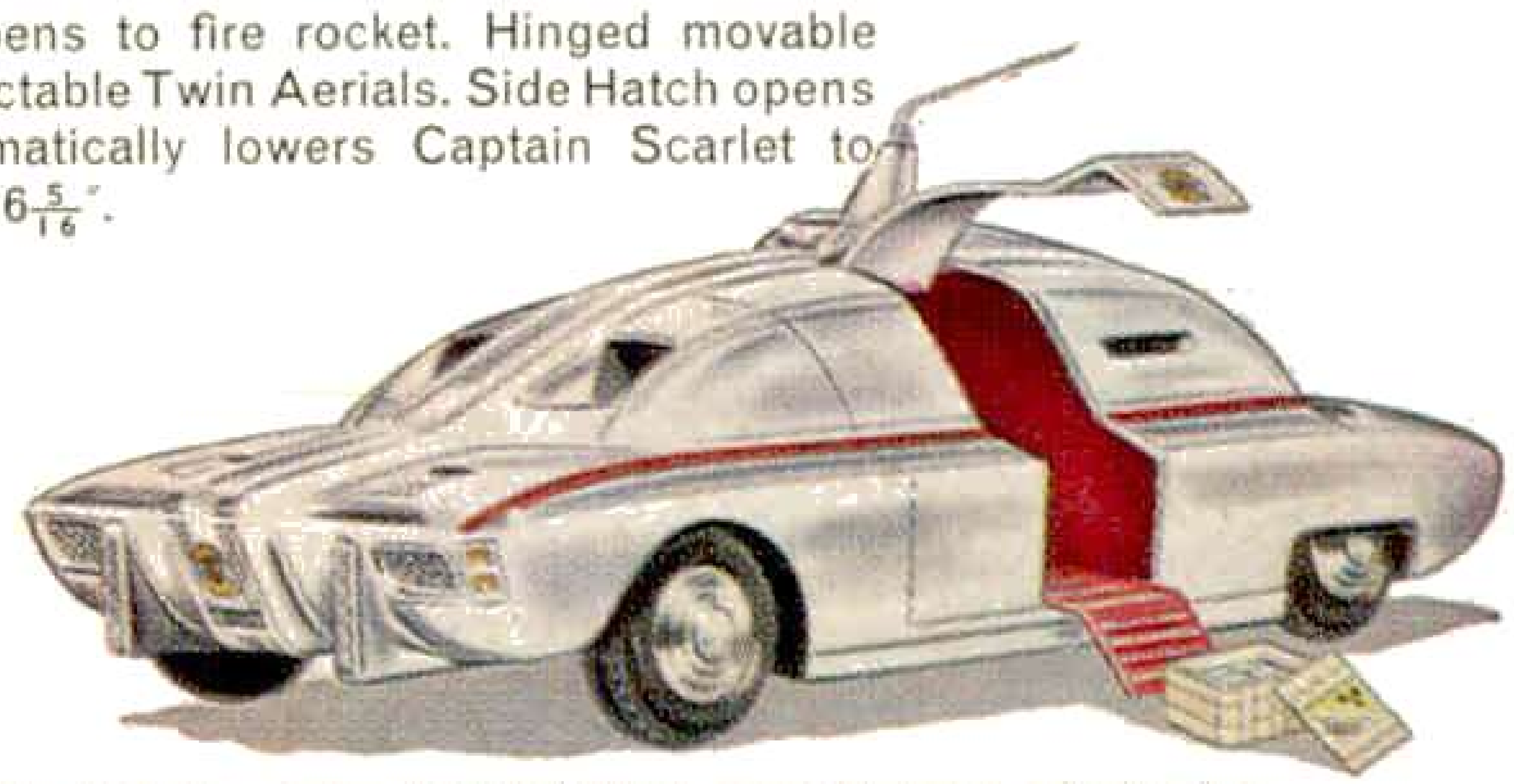
CAPTAIN SCARLET'S *Terrific Trio*



Model No. 104 SPECTRUM PURSUIT VEHICLE

Front Hatch opens to fire rocket. Hinged movable rear track. Retractable Twin Aerials. Side Hatch opens and seat automatically lowers Captain Scarlet to ground. Length 6$\frac{5}{16}$".





Model No. 105 MAXIMUM SECURITY VEHICLE

Opening Hatches. Drop down ramps. Crate containing isotopes. Suspension and Aerial. Length 5$\frac{11}{32}$".

Model No. 103 SPECTRUM PATROL CAR

Turbo-Jet engine noise. Aerial and suspension. Length 4$\frac{3}{4}$".

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